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Steel Shaft Sets on the Gogebic Iron Range

By A. L. Foss

Expansion of Mining Activities in British Columbia

By T. A. Rickard

Revisiting the Smelters at Douglas, Arizona

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Engineering and Mining Journal Ranks High in the Antipodes

THE Australasian Institute of Mining and Metallurgy publishes occasionally a list of recent articles on mining matters, "prepared for the purpose of placing before members the titles of the more important papers appearing in the usual publications concerned with mining engineering, metallurgy, etc."

The number of publications listed for the last quarter of 1927 was 42. The number of "important papers" published in that period, by a coincidence, was also 42. Twelve of these were scattered among 41 publications, The remaining 30, or over 70 per cent, appeared in the columns of *Engineering and Mining Journal.*

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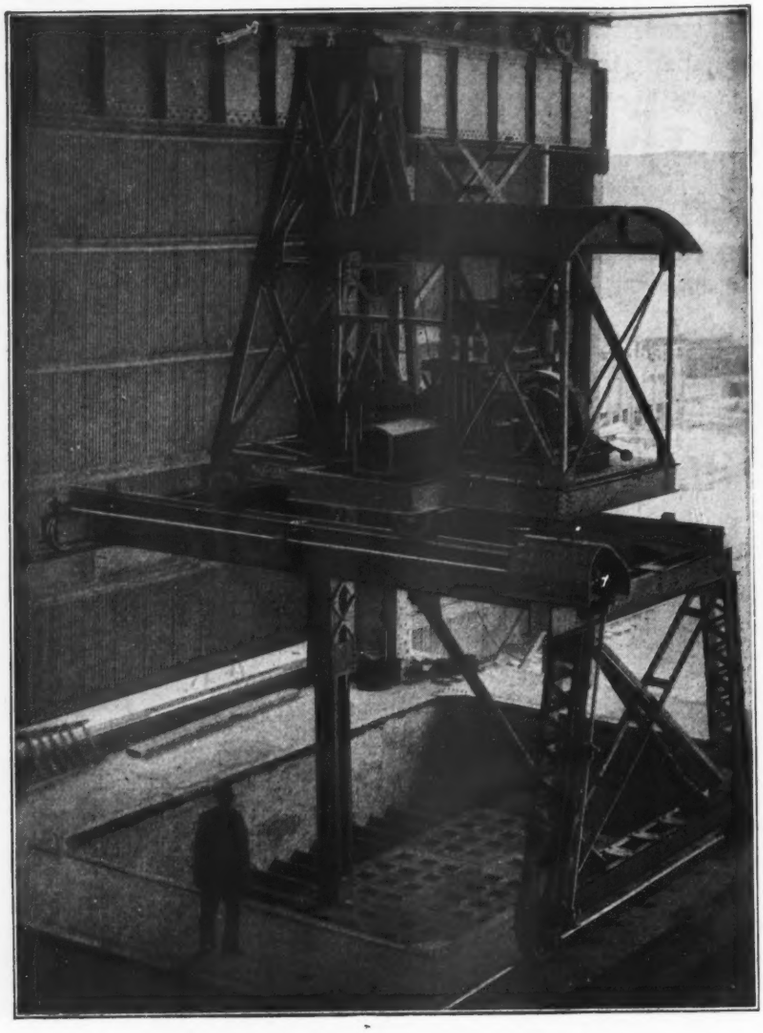

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ENGINEERING AND
MINING JOURNAL

McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, *President*

A. W. ALLEN,
Editor

VOLUME 126 *New York, September 29, 1928* NUMBER 13

Accident Prevention an Important Plank in Any Industrial Platform

TWO SIGNIFICANT EVENTS are forecast, interrelated yet each deserving of special attention. One is the subject of a proclamation by President Coolidge, that during the week beginning Oct. 7 a concerted effort be made to bring about a national consciousness of the waste resulting from accidental fire, the need for educational activity in stressing the importance of precautionary measures, and the exercise of adequate care to prevent fires. As the President avers, "The economic and social progress of the nation is dependent to a large extent upon the proper direction and control of all elemental forces within it." Property loss in 1927 from fires totaled nearly half a billion dollars, accompanied by a regrettable loss of life. Progress in the avoidance of this hazard has been made, as statistics indicate, but much of this is due to the use of non-flammable material in building construction. The co-operation of every agency is needed to bring home to the average citizen a realization of personal responsibility in the outcome of a campaign that has for its purpose the reduction of an appalling waste and an avoidable disorganization in industrial life.

Closely allied with fire prevention is accident prevention, and in this connection it is fitting that the attention of our readers should be drawn to the Seventeenth Annual Congress of the National Safety Council, to be held at the Waldorf Astoria, New York, beginning Oct. 2. Among scheduled speakers will be Mr. Howard I. Young, vice-president of the American Zinc, Lead & Smelting Company, of Mascot, Tenn., and Mr. Cleveland E. Dodge, of the Phelps Dodge Corporation. Round-table discussions on vital topics—such as the handling of men in cages and the prevention of mine fires—should create widespread interest and tend by giving publicity to successful results, to convince the mining industry as a whole that safety practices connote good business as well as an appreciation of humanitarian principles.

Educational work in safety-first methods has progressed amazingly in recent years. The problem is now mainly one of driving home to the employee the truism that the avoidance of accident must redound to his own ultimate advantage; of insisting on recognition of the fact that a great majority of the accidents that occur are preventable; and of seeing that no scruples are allowed to stand in the way of attaining immunity from major disaster, if not altogether from minor injury. But the safety-first movement has shown that a reduced death or accident rate is by no means the most important result achieved. It is helping to minimize disorganization and to further industrial effort.

When safety practices and precautions were first mooted it was considered that accidents are inevitable, and a lukewarm approval of a prevention campaign was the reaction from the majority. More recently, however, the feasibility of reducing the accident rate has suggested the setting of a new and higher goal of achievement. In most large mines and plants today much is being done to prevent accidents, not altogether from altruistic motives, or entirely because of a desire to lessen suffering, but because freedom from interruption aids efficiency, and any factor that aids efficiency is good business and must be based on common-sense principles. Prevention of accidents becomes automatic if they are anticipated, and this is made possible to a large degree by systematic recording of data relating to the conditions under which they have occurred in the past. The success achieved, however, should prompt greater effort in the future. The goal is to prove to the satisfaction of every employee that it pays to be safety-minded.

Why Does the Manganese Producer Find Financing Difficult?

THE QUESTION of a domestic manganese supply has been brought once again into the limelight by the recent convention in Washington of the American Manganese Producers' Association. The problem has its difficulties, the solution of which, it may be taken for granted, is earnestly desired by all interested in the matter, including officials of the War and Navy departments assigned the task of discovering how a sufficiency of the so-called strategic minerals may be assured this country in case of war. Their interest is professional as well as patriotic. With them, in full accord, is every private citizen who understands the peculiar importance of manganese and wishes to see the United States reasonably well prepared.

Besides this disinterested group, though undoubtedly overlapping it, is another composed of manganese consumers—the manufacturers of steel, dry batteries, and chemicals, the owners of manganese properties, and those who have invested in manganese mining enterprises. The consumers wish to be assured of a supply and to pay as little as possible for it. It is likely that they would prefer to buy at home if they could be satisfied as to grade, price and tonnage. The producers, actual and potential, naturally desire to make money. In some instances, the consumer is also a producer.

The situation as to the supply of manganese is well known: An abundance exists abroad, suitable as to grade and price, but not to be depended on in war time, and under the political control of diplomatic though

technically friendly nations in time of peace; at home there is a negligible tonnage of crude ore comparable to the foreign ore in grade, but a large quantity of lower-grade ores and manganiferous materials that must be beneficiated before they are usable. Beneficiation entails additional expense, and, because of this, beneficiated ore or concentrates can be sold in competition with high-grade imported crude ore only by virtue of the tariff, on which the domestic industry is completely dependent. Here is the problem, but not because the duty increases the cost of finished steel. The steel maker simply passes the duty on to the consumer, and the resultant increased price does not render him the victim of foreign competitors in the domestic market. If it did, he would promptly seek a remedy at Washington. The increase thus caused in the cost of steel per ton, moreover, is small. When spread over the consuming population it is negligible. The steel makers, it might be said, ought to be willing to pay in this manner for the research that may make them independent with respect to manganese.

The problem referred to comes when the owner of a manganese mine or prospect seeks financial aid or backing, so that he may develop his property. He finds a difficulty in getting the money. The success of his venture is too completely dependent on the tariff, the banker intimates. What if the tariff should be removed? The question carries the answer with it. As a result the negotiation terminates, and one more producer goes about complaining that the manganese industry has received a black eye.

The tariff has long been relied upon in the United States not only to provide revenue but also as a means to protect American industry, especially an infant industry, against foreign competition. The domestic manganese industry in its dependence upon such an artificial condition as tariff protection has many parallels. But these other industries have secured financial support, despite their complete dependence. Why should the manganese producer experience difficulty? In casting about for an explanation, two reasons suggest themselves: First, there may be increased opposition against the tariff on raw materials, which has its ill effect, especially with a Presidential election pending. Second, the average individual interested in manganese is so ignorant of the technique of mining and the possibilities of preparing the product that he is unable to talk convincingly to the banker whose assistance he seeks.

As to the first of these reasons, it is unfortunate that the government that grants a protective tariff cannot at the same time give assurance as to its continuance in force, if only for a limited period. Furthermore, whatever be the argument against a tariff on raw materials, surely manganese, in view of its peculiar and strategic importance, should be expressly excepted. As to the second reason, there is but one cure for ignorance, and that is education. The manganese miner must study manganese, the ways of mining and preparing it for market. He should also know the grade and quality of the ore he ships before he ships it. If all this be beyond his capacity, he should secure the services of those who have the necessary training. Otherwise he will not get far. In no case will he succeed without the tariff. The absolute essentiality of an adequate tariff, at least in the present position of the industry, cannot be too strongly emphasized. Without it there can be no domestic manganese industry. Without it the carbonate ores of Butte cannot be sintered and sold at a profit, nor can any leaching process be successful commercially, however perfect it may be technically. Nothing is to be gained by ignoring these basic facts.

Officers of the War and Navy departments who seek a solution to the problem of insuring a supply of manganese to hold in reserve in the event of war have, therefore, in the light of present knowledge, a definite course to recommend to Congress and to the Administration: They should urge that the domestic industry be fostered by adequate protection, in order that the country's low-grade manganese resources can be made available for use in the making of steel. Inasmuch as such a process of development will require time, they should also recommend that the government at once proceed to accumulate a stock of manganese ore to be held in reserve against a war emergency, giving preference to the domestic product to the extent to which it can meet specifications as to grade and tonnage. This stockpile has been spoken of before. The proposal was originally suggested by the joint committee on manganese of the A.I.M.E. and the Mining and Metallurgical Society of America. With such a stockpile it would be possible to take care of the needs of the country with respect to manganese in case war should occur again before a domestic industry had been developed. In time of peace, however, only through the tariff will it be possible to develop a domestic supply that will make the steel industry of the United States independent of foreign countries and free from the hazard that now exists.

Physiognomy as an Aid in Personnel Selection

IT IS CUSTOMARY to enjoin intending applicants for a position to inclose with their letters a photograph, which thereafter becomes an influencing factor in passing judgment. Physiognomists have made persistent claim that features are interpretable as evidence of failure or success, maintaining, moreover, that they may be used to forecast good or bad performance. This contention seems to have been exploded at the Wesleyan University, Middletown, Conn., where tests, made by two investigators and reported in a recent issue of the *Journal of Experimental Psychology,* indicated that features alone are useless as a guide to determine past occupation, or to estimate its outcome, or to predict failure or success in the future.

A twenty-fifth anniversary publication of an alumni journal, containing a large number of photographs of successes and failures—as judged by customary standards—provided the test material on subjects in the engineering, medical, educational, and legal professions. The photographs were isolated, and twenty observers were chosen, trained in psychological investigation work. They were asked to examine the isolated photographs and to express an opinion as to what vocation had been followed, and to what extent success had been attained. The result indicated that, even to a trained observer, it is impossible to determine what vocation a man has followed, the extent to which he has succeeded or failed, or what work he is best fitted for. As an instance, the results of the tests indicated a majority conclusion that one photograph was that of a clergyman, whereas it depicted a successful engineer. A failure as an educator

was quoted a successful banker. The features of an alumus who had failed at law were considered to belong to a successful merchant. Most of the photographs were considered to depict successes, whereas many represented failures.

For the determination of capability and character, the photograph test would therefore appear to be apparently worse than useless. The question hinges, however, on what is used as the yardstick to measure success. In the present instance it was assumed that material advancement and increased earning capacity in a chosen field is equivalent to success, whereas inability to rise above a subordinate position spells failure. After all, this indicates the qualities that are needed by the employer, but in many instances the possession of such qualities does not insure success. Occasionally the power to make or break a subordinate is in the hands of an inefficient executive who may surround himself with sycophants whose loyalty is measured by long service and an invariable acquiescence in the policies and opinions of their superior. In popular parlance such persons are known as "yes men." Under such conditions the exercise of zeal by a subordinate is likely to be discouraged, lest exposure and embarrassment follow in high places. It is so easy to discourage the initiative of a progressive, permit a decent interval of time to elapse, and then allow the valuable idea to be elaborated and applied by a more loyal employee. This form of plagiarism causes much litigation in theatrical circles.

In public service and in private enterprise only one type of loyalty is worth encouragement—loyalty to ideals of service, truth, and efficiency. If these qualities are characteristic of a directing organization head, or of an immediate superior, a personal loyalty will follow as a natural sequel. But loyalty to the individual will be a hollow sham if it is not engendered by conviction as to the character and purpose of that individual. Physiognomists and psychologists may both be right—to some extent—in the evaluation of ability by photograph. The point that is sometimes overlooked is the souring effect that lack of opportunity may have on zeal and initiative.

Copper Price Shows Steady Return to Normal

IN THE three weeks ending with September 19, the domestic sales of copper reached the astounding total of 117,000 tons, a record that has not been equaled in years, if ever. Practically none of the metal was for prompt delivery or for delivery later than November. Moreover, this huge volume of business was preceded by a normal volume of buying throughout August, so that it is evident that the recent activity was neither a speculative move on the part of consumers, nor was it forced because their stocks had been reduced to the danger point. Rather it was induced by numerous favorable industrial conditions that brought copper consumers to the realization that their business this fall would be better than they expected—perhaps of unprecedented proportions. Foreign sales have also been excellent. They promise to set a new record this month.

The improvement that, in all probability, will be recorded by the copper industry this year will refer to production, consumption, price, and profits. In 1925 the world produced only four per cent more copper than in 1924; in 1926 and in 1927, respectively, only three per cent more than in each of the preceding years; but the world production in 1928 promises to be about 1,880,000 tons, or twelve per cent more than last year.

The industry is coming into its own, for the first time since the World War. Increasing demand, which indicates world prosperity, is the fundamental reason for the improvement. Some are wont to give the credit for the advance in price to the closer association of producers achieved this year; but it must be realized that the recent appreciation in price could not have occurred without a demand that justified it, though the work of the Copper Institute, the Copper Export Association, and the American Bureau of Metal Statistics, without doubt, has had a salutary effect on the industry.

The New York *Journal of Commerce* states that the recent increase in price indicates that "the government is becoming more lenient with combinations tending toward the restraint of trade, or combinations in business enterprise are becoming bolder—or both." One would hardly say that boldness on the part of producers was required to advance the price of copper one-quarter cent in view of the prevailing situation—scant stocks, keen current demand, and every prospect of continued industrial activity during the coming months. Indeed, the wonder is that some advance had not developed earlier. Certainly no follower of the copper market could with justice charge the producers with rapaciousness in an advance of a quarter of a cent per pound. No copper Institute was in existence before 1928, yet in 1925, 1926, and in the early part of 1927, significant advances in prices occurred. In the buying wave of early August, 1925, the price advanced five-eighths of a cent in twelve days; in that of July, 1926, the advance was five-eighths of a cent in twenty-nine days; in that of February, 1927, the price of copper rose seven-eighths of a cent in twenty-one days. In none of these instances, be it noted, did sales even approach in amount those of the last three weeks, yet the recent advance, after twenty-one days of frenzied buying, was only a quarter of a cent!

Mr. Hoover several years ago publicly stated:

"While our industry and commerce must be based upon incentive to the individual, yet the national interest requires a certain degree of co-operation between individuals in order that we may reduce and eliminate industrial waste, lay the foundation for constant decrease in production and distribution costs, and thereby obtain the fundamental increase in wages and standards of living."

Fifteen cents is a generally satisfactory price for copper, from the standpoint of both consumer and producer. Though but little above the pre-war price, and, in comparison, far below the prices being charged for most other commodities, it will assure a reasonable profit to the producers as a whole, whose zeal in reducing production costs deserves reward. Some companies will still remain near the border line of profit and loss, but this will happen in any event, and it is the welfare of the industry as a whole that must be considered. Increased income will mean more opportunity for the expansion of research and welfare activities and the modernization of plant and equipment. With the industry in a more stabilized condition, opportunity should arise for an extension of profit-sharing by employees through the acquisition of stock—a consummation greatly to be desired in the interests of satisfactory industrial relations, without which no enterprise can hope for continued prosperity.

The PRESIDENCY *of the* INSTITUTE

AN ENGINEER in Mr. F. W. Bradley's exploration department said: "I first met Mr. Bradley in Nevada City under the following circumstances: I was a small boy and had just been in a single-handed fight with several of the youngsters about town. I was considerably the worse for wear, and was down in the dust of the road, when a thin, angular man approached and helped me up, leading me to a near-by pump, where he bathed my face and said, 'You have had a hard time of it, but you put up a good fight.' That was Mr. Bradley."

Mr. Bradley's interest in young men is shown by his establishment of a loan fund for mining students and an annual prize in mining at the University of California, where he was a student for three years. Another plan, now in formation, is the establishment of a permanent field camp for mining students at the Sulphur Bank quicksilver mine, near Clear Lake. Apart from this, Mr. Bradley is training his own sons in the business of mining. The oldest one is in charge at Sulphur Bank, and the next oldest has just become superintendent of the Spanish mine.

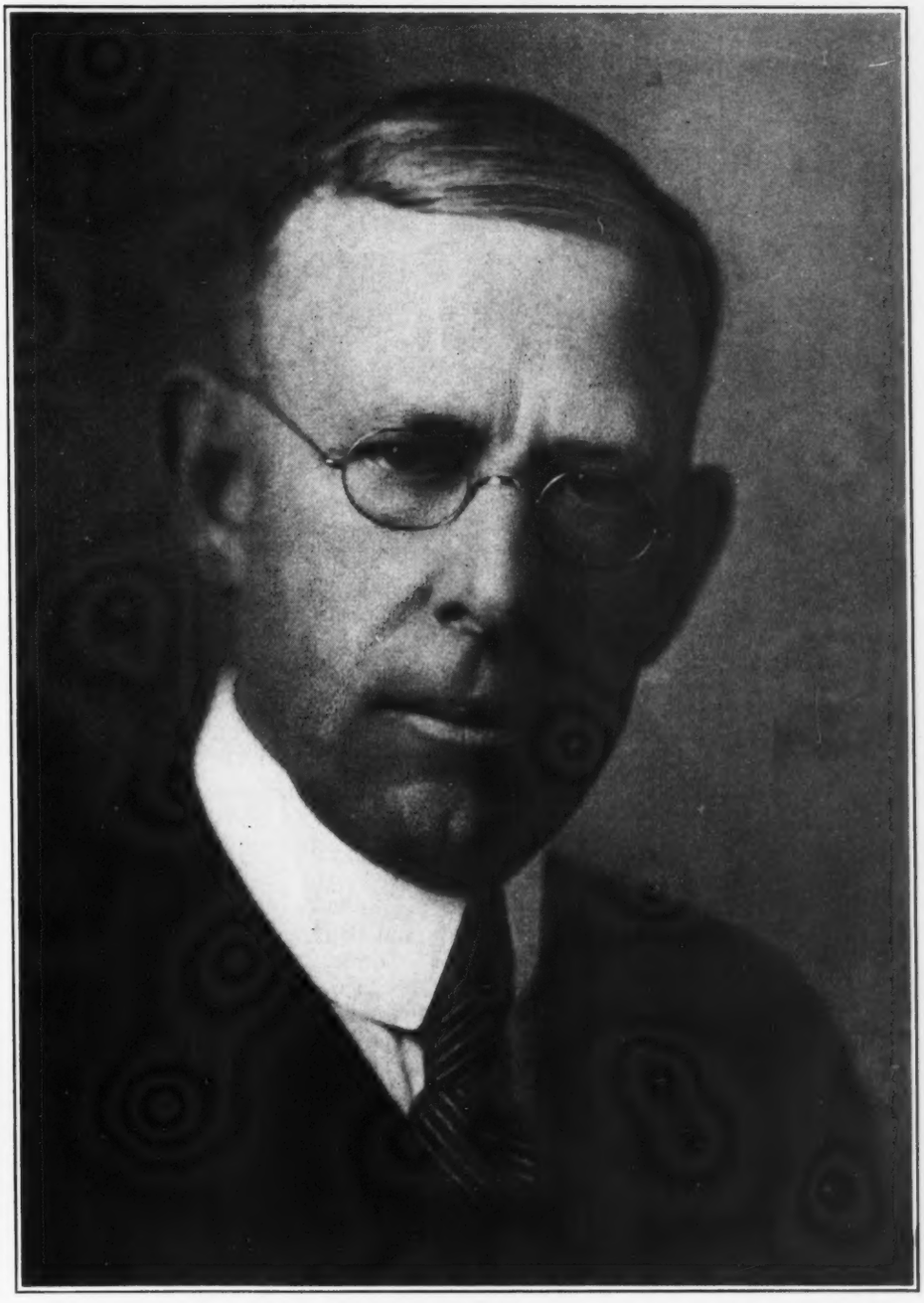
AS A BOY, Mr. Bradley had to work his own way, and this fact no doubt has directed his attention to constructive efforts in advancing young men of initiative. His early manhood was in the mining districts of Nevada County, Calif. That he built a substantial foundation is shown by the fact that in 1890 he was offered and accepted a position at the Bunker Hill & Sullivan mine in Idaho. Within three years he was advanced to manager, and in 1897 to president of the company, since when he has administered the affairs of this important enterprise. Mr. Bradley is an able administrator. He selects men, establishes company policies, advises on operation and maintains intimate touch with the affairs of his companies. His present organization investigates and acquires properties, finances and operates.

THE history of the Bunker Hill enterprise has been given by Mr. T. A. Rickard. *Engineering and Mining Journal* published a biographical sketch of Mr. Bradley in the Dec. 17, 1921, issue. Since then the Alaska Juneau enterprise has been established on a substantial basis in the face of great difficulties. The application of selective mining on a broad scale in conjunction with selective milling has made a productive enterprise. Mr. Bradley's tenacity and his grasp of fundamentals are well shown by his refusal to abandon Alaska Juneau in the face of a widely held opinion that the property could not be made to pay. A way was found, exceptionally low costs were attained, better-grade ore was mined, and remunerative employment in the Juneau area was maintained.

IN THE Cœur d'Alene district of Idaho, the Bunker Hill smelter has been an important factor in affording a market for ores and concentrates. It has prospered, as has also the Bunker Hill company. The Star mine was acquired in conjunction with the Hecla Mining Company. An exhaustive metallurgical research campaign under the leadership of U. C. Tainton was directed to the development of methods for the treatment of the zinc ores of the Star mine. At its conclusion, the Sullivan Mining Company began the erection of an electrolytic zinc plant based upon Tainton's plans, which has been completed and is now in operation. In conjunction with the Bunker Hill smelter, the metallurgical equipment near Kellogg not only converts the ores of the company's mines, but also receives custom ores and produces gold, silver, refined lead, antimonial lead, and electrolytic zinc of high grade. A subsidiary, the Northwestern Lead Company, at Seattle, Wash., is engaged in the fabrication of lead products, and markets in the Pacific Coast and intermountain areas. The Bunker Hill & Sullivan company has been active in the exploration of mineral properties in the Cœur d'Alene district, and in this respect has also greatly encouraged the mining industries in the region.

MR. BRADLEY'S adventure in the Mayo district, Yukon Territory, resulted in the establishment of a profitable mine in the Mayo claims of the Treadwell Yukon. A concentrating mill was erected in 1924, since which time production has been made and the property has materially prospered and grown. In 1925, Treadwell Yukon secured options upon 6,000 acres in the Chelmsford area of the Sudbury district, Ontario. A diamond-drilling campaign indicated widespread occurrences of very complex zinc-copper-lead-silver and gold

ores in an important shear zone, and the Errington mines were started. Underground mine exploration and development have been actively under way. A pilot mill has also been started and the working out of the details of ore treatment has begun. The Treadwell Yukon also acquired a mining property at Tybo, Nev. As a result of deeper exploration, important extensions of orebodies were found and a mill is to be erected. While these major developments were in the making, Mr. Bradley found time to continue his quicksilver mining activities. He acquired and worked out a property in Nevada, and brought the Opalite mine, in southern Oregon, near the Nevada line, to production. The Sulphur Bank property, in Lake County, Calif., was taken over and a modern reduction plant was installed. A mill for the treatment of 500 tons per day of low-grade quicksilver ore is now being erected. Among the latest properties to be acquired by Mr. Bradley is a gold and quicksilver prospect in the Yellow Pine district of Idaho. The metallurgical problems are being solved, and a metallurgical plant will be erected soon. The Atolia tungsten property, in California, was incorporated in 1906. Steady production of tungsten concentrate was made until the company temporarily ceased operations in 1919, but immediately upon the recovery of the tungsten market production was resumed and has continued ever since and promises to continue for many years. For a considerable time the property was the most important tungsten producer in the United States. The mining industry is too often considered from its material aspects—production, equipment, technical procedure, mineral deposits. The virile element of the industry is accepted too casually. Men—prospectors, engineers, managers, workers, financiers, operators, and others—make the industry. Upon their initiative, courage, vision, and resource must the mining industry depend for its maintenance, growth, and stability. True enough, mineral deposits are necessary, but upon human capacity and courage to take chances must depend their successful development. The West has been conspicuous in the number of its successful miners.

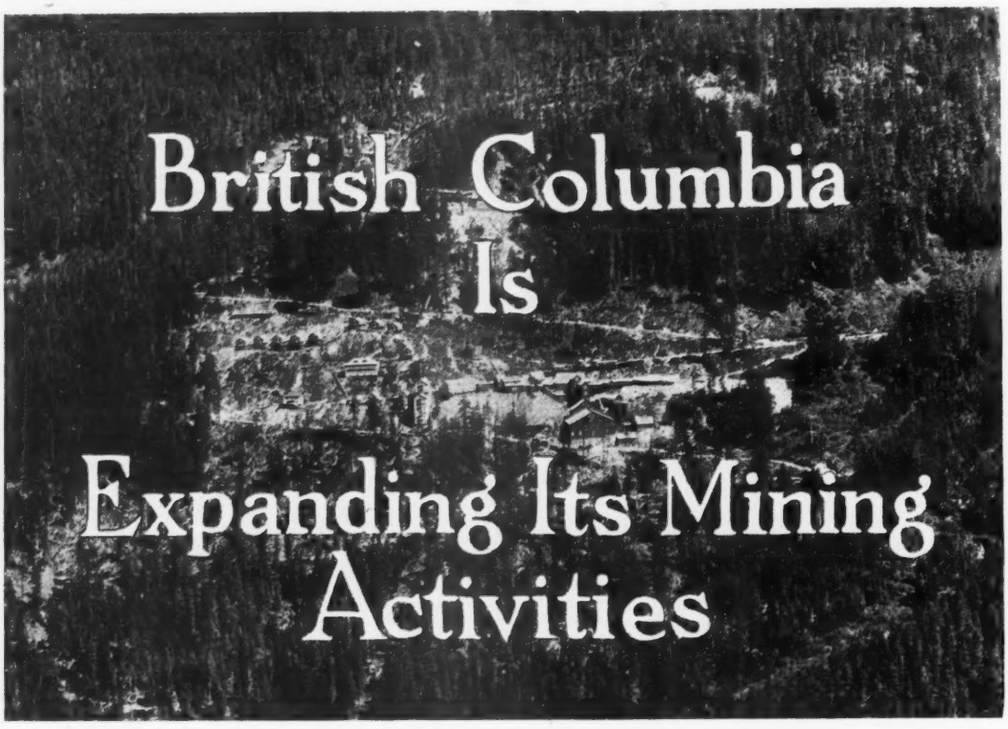


FREDERICK WORTHEN BRADLEY

Frederick Worthen Bradley has played a leading rôle in the development of the mining industry. Instead of retiring with well-earned laurels, as some have done, he prefers to stay in the game, where his experience and power are especially effective. The recent action of the San Francisco Section of the American Institute of Mining and Metallurgical Engineers in suggesting him for the presidency of the Institute in 1929 is in recognition of his achievements. The Institute will be especially honored in selecting as its president one of the conspicuous mining leaders in the West—a man whose character and achievements will assure to the office both honor and distinction.

British Columbia Is Expanding Its Mining Activities

By
T. A. Rickard
Contributing Editor, San Francisco



The Premier mine, in a clearing amid the pine forest

THE MINING INDUSTRY of the Canadian province of British Columbia continues to present a cheerful aspect, even though the prices of lead and zinc have declined in the last two years and thereby diminished the profits of operation. The mineral output in 1927 was the largest aggregate production recorded in the annals of British Columbia, although less in value on account of market conditions. The total value of production from the province to date is $1,048,837,828; in 1926 it was $67,188,842, and in 1927, $60,729,358, whereas the tonnage of ore mined last year was 5,416,021 tons, which was an increase of 640,948 tons over the output in 1926. Estimates justify the confident expectation that the output for the current year will show a further increase.

A glance at a graphic representation (Fig. 1) of the production since 1892 shows the rapid growth of the mining industry, the only product that has not been forthcoming on an ascending scale being placer gold; but this, of course, is the history of all mining regions, because placer gold represents a geologic cream that is easily and rapidly skimmed. The recent dividend record is excellent, the total distributed having been $9,747,270 in 1926, $10,800,833 in 1927, and in 1928 it is estimated that the proprietors of mines will receive $12,000,000. As mining is the art of exploiting minerals for the purpose of profit, these dividends represent the milk in the coconut. The statistics in Table I are self-explanatory.

Sullivan Mine Big Factor

The most significant items are the increasing outputs of lead and zinc, attributable to the expanding operations of the Sullivan mine, owned by the Consolidated Mining & Smelting Company of Canada, which is much the most important operative unit in British Columbia. The Consolidated company was organized in Canada in 1906 to acquire a consolidation of properties, which included the smelter at Trail, together with the St. Eugene, War Eagle, and Center Star group of mines. In 1910 the company purchased the control of the Fort Steele Mining & Smelting Company, a subsidiary of the Federal Mining & Smelting Company, and thereby secured the Sullivan mine, at Kimberley, in the East Kootenay. This mine has made the Consolidated a greatly profitable en-

Table I—Quantities and Value of Mineral Products for 1925, 1926 and 1927

Description	1925		1926		1927	
	Quantity	Value	Quantity	Value	Quantity	Value
Gold placer, oz	16,476	$280,092	20,912	$355,303	9,191	$156,247
Gold, lode, oz	209,719	4,335,269	201,427	4,163,859	178,001	3,679,601
Silver, oz	7,654,844	5,286,818	10,748,536	6,675,606	10,470,185	5,902,043
Copper, lb	72,306,432	10,153,269	89,339,768	12,324,421	89,202,871	11,525,011
Lead, lb	237,899,199	18,670,329	263,023,937	17,757,535	282,996,423	14,874,292
Zinc, lb	98,257,099	7,754,450	142,876,947	10,586,610	145,225,443	8,996,135
Coal, tons, 2,240 lb	2,328,522	11,642,610	2,330,036	11,650,180	2,453,827	12,269,135
Coke, tons, 2,240 lb	75,185	526,295	(a)	(a)	(a)	(a)
Structural materials and miscellaneous minerals	.....	2,843,110	.....	3,675,128	.....	3,326,894
Totals	.....	$61,492,242	.....	$67,188,842	.....	$60,729,358

(a) Coke not included in primary mineral production; coal used in making coke included in coal figures.

Table II—Production of Consolidated Mining & Smelting Company of Canada

Year	Ore Smelted, Tons	Gold, Ounces	Silver, Ounces	Lead, Pounds	Copper, Pounds	Zinc, Pounds
1925	1,133,523	20,516	4,704,635	236,079,266	366,439	97,910,147
1926	1,354,821	50,075	7,178,817	262,105,431	21,263,988	135,092,654
1927	1,405,872	29,490	7,179,607	291,043,120	18,522,742	147,054,623

terprise. The first shipments of ore from the Sullivan were made in 1913, but it was not really productive until the completion of the mill in 1923 enabled the ore to be properly beneficiated. The capital of the company is $15,000,000 in $25 shares, which were quoted at $48 apiece in 1925 and rose to $289 three years later. Its dividend record is eloquent:

1924	6 per cent	$641,043
1925	6 per cent plus $5	3,238,054
1926	6 per cent plus $8	5,078,492
1927	10 per cent plus $10	6,358,875

Surplus at the end of 1927 was $13,199,696, against $12,398,109 at the end of 1926 and $8,723,975 a year earlier. The scope of the company's business is indicated by its diversified output of metals shown in Table II.

The smelter at Trail produces six metals by electrolytic refining—namely, the two precious metals, the three base metals, and to these is now added cadmium, a plant for the recovery of this useful metal having been started in April of the current year. Cadmium, an associate of zinc, is used in the production of alloys and for metal plating. The Consolidated company, thanks to the Sullivan mine, is producing 10 per cent of the world's lead and 7 per cent of its zinc. S. G. Blaylock is general manager, and is highly esteemed by the members of our profession. A few months ago he was awarded the Douglas medal of the American Institute of Mining and Metallurgical Engineers in recognition of the work done by him and his associates in the successful devising of a process of selective flotation adaptable to the complex ore of the Sullivan mine. This ore, an intimate mixture of galena, blende, pyrite, and pyrrhotite, was a metallurgical conundrum for many years, and in this respect followed in the wake of the Algerian bluestone, the Broken Hill ore, and that of the Bawdwin mine, in Burma. Sullivan ore contains 11 per cent lead, 10 per cent zinc, and 3 oz. of silver per ton. The Consolidated company is chary of giving information, but I understand that by use of soda ash and sodium cyanide the lead sulphide is separated from the zinc sulphide, and that then the effect of these reagents is neutralized by the addition of copper sulphate, together with sodium bichromate, so as to facilitate the clean concentration of the zinc. The lead concentrate averages 65.7 per cent, with 4.5 per cent zinc, whereas the zinc concentrate contains 41 per cent zinc, with only 3.5 per cent lead. Difficulty with dust in the mill has been obviated by the addition of a complete system of fans.

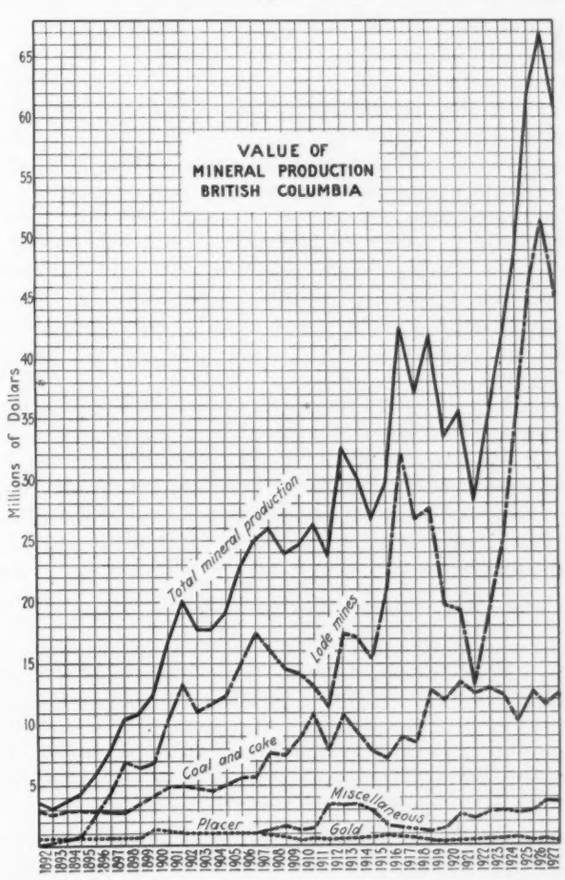
Production of Sullivan 4,000 Tons per Day

The output of the Sullivan mine was increased to 4,000 tons daily in October last, and a further increase will come in due course when the supply of electric power is proportionately increased. Consolidated controls the Kootenay Power & Light Company, which exploits the falls of the Kootenay River at Bonnington. An additional output of energy equivalent to 75,000 hp. will be available next year. Another power plant is to be built by the company on the Pend d'Oreille River, presumably for the same purpose—namely, to expedite the productivity of the Sullivan mine, the ore reserves of which are enormous. The lode is 200 to 240 ft. thick, and the deeper exploratory work has been satisfactory, so that the tonnage assured is said to suffice for 50 years. Production of lead and zinc in 1928 will be 25 per cent more than in 1927. Another 100-ton unit is being added to the zinc plant at Trail.

To the multifarious activities of the Consolidated company has been added the mining of lime phosphate, of which extensive deposits have been found in the Fernie district. This phosphate is too low a grade for direct treatment with sulphuric acid, so that experiments in concentration are being made, and some of the resultant superphosphate is now being shipped tentatively to the dominion government's experimental farms in the prairie region eastward. The idea is to utilize the pyritic portion of the Sullivan ore in the production of sulphuric acid for phosphate manufacture, as has been done by Anaconda Copper near Butte, Mont.

The smelter at Trail has played a useful part in the stimulation of provincial mining, the treatment of custom ore having aided many small producers. Recently the concentrator originally used for testing the Sullivan ore at Trail has been diverted to custom milling. At Moyie the Consolidated company is re-treating the tailing dump of the old Sullivan and Eugene mills, using a

Fig. 1—Graphic representation of province's mineral production



clamshell dredge where this material has been deposited in a lake.

The operations of the Consolidated company are impressive, but the most interesting phase of mining in British Columbia at this time is the number of old and supposedly exhausted mines that are being reopened, many of them with apparent signs of success. During recent years the increase of output in the province has been credited chiefly to the enlarged operations of sundry well-established mines, such as the Sullivan, Premier, Anyox, and Britannia, whereas now a further increase is forthcoming in consequence of the progressive development of small mines that have lain dormant and have come to life by aid of new metallurgic methods, such as selective flotation, whereby low-grade and complex ores can be beneficiated profitably. Four mills in the Slocan district are examples of this trend: the Whitewater, Lucky Jim, Ruth Hope, and Hewitt. Of these, two are new mills and two are old concentration plants that have been remodeled. The same general remark applies to the Bridge River district, near Lillooet, where several old gold-producing mines have become enlivened by aid of better transport and more efficient metallurgy, the cyanide mill replacing stamp-mill amalgamation. To this group belong the Pioneer, Coronation, Lorne, and Wayside mines.

Premier Buys Additional Ground

The northwestern district, identified chiefly with the Portland Canal, is forging ahead, despite a rugged topography and the physical difficulties incidental thereto. Progress, it is true, has been slow, despite the celebrity given to the district by the riches of the Premier Gold Mining Company, which recently has acquired new territory: the Prosperity, Porter-Idaho, and Silverado groups of claims. These contain high-grade silver-lead ore, and the Premier has acquired control of them by means of subsidiary companies. The output of the Premier consists partly of crude ore that is shipped directly to the Tacoma smelter and partly of concentrate coming from a flotation mill. This also goes to Tacoma; and Anyox gets a small tonnage of low-grade that is used as a siliceous flux.

Now a tramway of the Riblet type, 5½ miles long, is being built at a cost of $150,000. This will serve two of the new mines, and thereby obviate an expenditure of $50 per ton by packing the ore on horseback. Heretofore an ore having an assay value of $100 from the Porter-Idaho was needed to meet expenses. The terminal of the tramway is at tide-water at the mouth of the Marmot River where it enters the Portland Canal, near the town of Stewart. Some of this product may go to the Selby smelter, at San Francisco, for the Premier is operated under control of the American Smelting & Refining Company. H. A. Guess is vice-president and general manager, at New York, and Dale L. Pitt is the energetic resident manager.

Premier Owns 38 Per Cent of B. C. Silver

The output of the Premier has been steady, ranging from $3,267,213 in 1925 to $3,782,032 in 1926, and $3,737,656 in 1927, when 118,842 oz. of gold and 3,396,082 oz. of silver constituted the yield. Dividends distributed have been $1,600,000 per annum from earnings of $2,013,481 in 1925, $2,211,490 in 1926, and $2,201,406 in 1927. The total of dividends from March, 1921, to January, 1928, has been $11,752,000. Premier company owns, also, 38 per cent of the stock of the B. C. Silver Mines, Ltd., a company that, in turn, is controlled by the Selukwe Corporation, of London. The property of the B. C. Silver Mines adjoins that of the Premier, and development has been resumed after abortive negotiations for a complete sale to the Premier company. A mill is to be built soon. C. A. Banks is resident manager. At the last annual meeting he stated that 466,000 tons of ore, having a gross value of $6,590,000 (or $14.14 per ton), had been proved, and of this gross value about one-half could be estimated as profit. Another mine in this vicinity, the Big Missouri, has been acquired recently by Consolidated Mining & Smelting. This mine is about 6 miles up Cascade Creek, beyond the Premier, and is a property characterized by handsome exposures of ore, which are now being explored by drilling, tunneling, and detailed geologic investigation, under the direction of W. M. Archibald. Besides these larger operations, there are, in the Portland Canal district, a couple of dozen prospects controlled by small local companies, all of which are being developed in the reasonable expectation of developing some of them into real mines. The town of Stewart is the focal point of the district, and its status may be gaged by the fact that a mining convention was held there in the early part of September.

Granby Opening Bonanza

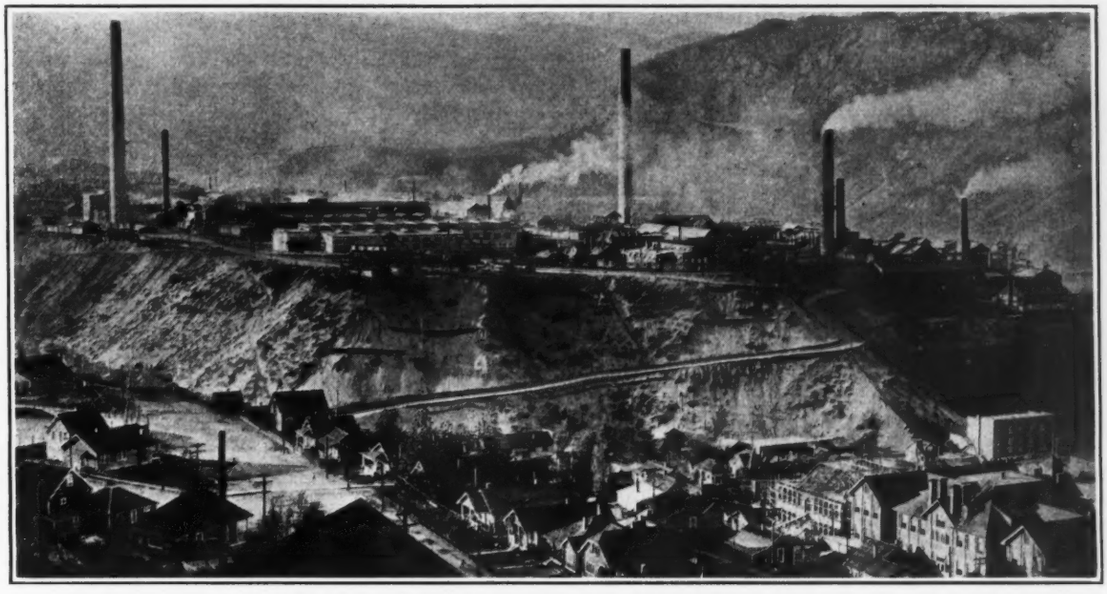
Halfway between Stewart and Prince Rupert is Anyox, where the Granby Consolidated Mining, Smelting & Power Company continues to operate the Hidden Creek mine, mill, and smelter, with increased efficiency, thereby enabling a lower-grade ore to be beneficiated and a record in the way of maximum production of copper to be achieved—namely, about 4,000 tons daily of ore that averages 1.3 per cent. The company is opening up and equipping a new mine known as the Bonanza, which is situated only 2 miles from its present center of operations. This new property has been diamond-drilled and otherwise explored so as to justify the erection of a tramway to deliver the ore to the Anyox mill. About 1½ million tons is said to be assured; sufficient at least to strengthen the company's position appreciably. The Swedish American electrical method of prospecting has been used to explore the diorite-schist contact along which the Hidden Creek orebodies are distributed, but no technical information concerning this scientific exploration has been forthcoming.

This stupid form of secrecy unfortunately characterizes all the big companies working in British Columbia, and constitutes a regrettable feature of mining operations in the province.* To the directors and managers I commend the observations that James Douglas, an engineer honored as much in Canada as in the United States, made on "Secrecy in the Arts," many years ago, in July, 1907, before the American Institute of Mining Engineers. Among other remarks he said that "the best correction to the growth of dry-rot is the banishment of secrecy." He said also that "the spirit of secrecy is intimately allied with the spirit of suspicion and distrust; and the mind which is always suspecting is closed tight against the admission of fresh and fair impressions." The able and distinguished man that said this was himself the head of important mining enterprises. I commend his ideas to those that control mining and smelting enterprises in British Columbia, and elsewhere.

In the northeastern district, which covers the central interior of British Columbia, the most prominent mine is

*Remembrance of instances indicating commendable frankness and wholehearted co-operation suggest dissociation from Mr. Rickard's sweeping censure.—Editor.

the Duthie, which produces a silver-lead concentrate and a zinc concentrate from a well-defined vein that traverses rhyolite and andesite. A 60-ton flotation plant was started last year. It is a small enterprise as yet, but has prospects of favorable growth. This is typical of the district, which includes a number of promising properties capable of producing a similar complex ore, in which silver is the principal metal, with a little gold. Cariboo is in this district, but that old mining center is "fading out of the picture." A dredge that went to work two years ago has proved a failure on account of the hardness of the limestone bedrock, which was found where the softer schist was expected. The resident engineer for the district, Douglas Lay, gives the local production as only $53,125 in 1927, and he refers to the dredging operations of the Kafue Copper Development Company in that connection, which is interesting because the name, like that of the Selukwe Corporation, excites the geographic imagination by suggesting a violent jump from British Columbia to lands far away. I crossed the Kafue, one of the tributaries of the Zambesi, three years ago.



The smelter of the Consolidated Mining & Smelting Company of Canada, at Trail, B. C.

British Empire's Biggest Copper Producer

The western district includes the Britannia mine, owned by the Howe Sound Company, which also owns the El Potosi and Calera mines, both in Chihuahua, Mexico. The Britannia is said to be the most productive copper mine in the British empire. This sounds like a challenge to our friends in Northern Rhodesia! Production in 1925 was $8,684,998; in 1926 it was $13,797,373; and in 1927, $13,393,179. The net profit in these three years was consecutively $947,306, then $2,697,749, and lastly $2,142,115. The dividend has been increased from 44c. per share in 1925 to $3.50 in 1926 and $4 in 1927 on 496,038 shares of stock. Last year the output consisted of 10,337 oz. of gold, 2,931,317 oz. of silver, 34,949,417 lb. of copper, 67,437,136 lb. of lead, and 54,921,350 lb. of zinc. The Schley family has been long and honorably identified with this fine enterprise. E. B. Schley is chairman of the board of directors, in New York.

C. P. Browning is resident manager, and as such he has won an enviable reputation. Operations are characterized by excellent management and progressive metallurgy. A milling plant built to treat 3,000 tons daily is now treating 5,000 tons. Besides the ordinary copper concentrate, the mill yields a concentrate of iron pyrite at the rate of 5,000 tons per month. This contains 50 per cent of sulphur, and most of it is shipped to the Nichols Chemical Works at Barnet, near Vancouver, the remainder going to California, for the manufacture of sulphuric acid. The tailing at the Britannia mill is said to contain 0.12 per cent copper. A deep-level adit has rendered the use of the tramway superfluous, except for carrying supplies, such as timbers, to the upper workings. The Britannia reports, like those of the other larger companies, are more remarkable for their omissions than for the information they give. Ore reserves are not stated for 1927, but in 1926 the total of ore blocked out and broken in the stopes was reported to be 6,649,000 tons, as against 5,643,000 the year previous. The mine is generally supposed to have ten years' life assured at an output of 1½ million tons per annum. A large unexplored area remains in the schist, which, more properly, is a much-sheared quartz-porphyry.

Developments at Coast Copper Mine

An interesting mine in the making is the Coast Copper, at Quatsino, on Vancouver Island. This mine is controlled by the Consolidated company. It contains copper ore enriched with a little gold. The big smelting company has been developing the mine for ten years, and, true to its usual policy, has given no information to its shareholders, or to the public, in consequence of which there has been some wild speculation in the little stock that is outstanding. No production has been made as yet, but the mine is developed to the 1,200 level, at which depth the orebodies are said to be larger and of better grade than in the upper parts of the mine. A winze is now being sunk to 600 ft. below the 1,200 level, but no plans for the future have been announced. A 17-mile railway, a mill, and a smelter will be required to bring this property to fruition. Consolidated also owns the Sunlock, a low-grade copper prospect, partly developed,

but dormant now, the expectation being that the output from this mine eventually will join that of the Coast Copper, or that together they will constitute an operative unit of some importance. The same company, Consolidated Mining & Smelting, has an option on the George Copper Company, which owns prospects on the Bear River, near Stewart, in the Portland Canal district. Diamond drills are at work, testing several veins that show prominent outcrops on the high ridges overlooking

The Britannia flotation mill of the Howe Sound Company

the river valley. Stock speculation has been rampant in the stock of this prospective company also, the quotation having risen from 50c. per share last year to $5 recently. Having regard to the lack of information, this can be regarded only as a blind gamble.

Allenby Concentrate Goes to Trail

The Boundary country is dead, but the adjoining district of Princeton can boast the Copper Mountain mine, originally developed by the B. C. Copper Company, of Greenwood, and later absorbed by the Granby company, as its Allenby unit, which is operating it steadily, 2,000 tons of ore going daily to the flotation mill. The product, a copper concentrate, is shipped to Trail, where a reverberatory furnace was built last year to treat the ore. Copper Mountain is a high-cost producer, 10 to 10½c. per pound, but a profit is made, as to which the company's report vouchsafes no precise information.

The coal-mining industry of Vancouver Island presents no new features, the only matter calling for remark being the productive capacity of the mines, which is about 35 per cent higher than the consumption, on account of the aggressive competition of California oil. Apparently, the best chance of improving the position seems to be the further use—safely—of pulverized coal in power plants. The provincial government is aiding investigation for this purpose, having made a grant of $12,000, to expedite the use of pulverized coal in coastwise shipping. The Crowsnest coal field, in the eastern part of the province, is prosperous. Capital and labor are on friendly terms, and new markets for coal have been found. Some of it is used on the Great Northern and Canadian Pacific railroads; some goes to the prairie country as far east as Winnipeg; and a little is consumed at the Trail smelter, where, however, the requirement of coke is decreasing, because of the tendency for hydrometallurgy to displace smelting.

In general, a lively disposition marks the mining industry of B. C., of which it may be observed now that its technical methods are A.D. This cheeriness characterizes a folder recently issued by the Department of Mines and compiled by John D. Galloway, the Provincial Mineralogist, who is fully maintaining the honorable traditions of his office. In the brochure to which I refer the statement is made, advisedly, that in the last 25 years more of the metals has been consumed than in all previous time. This emphasizes the fact that modern civilization, in a material sense, is on a metallic basis. and that the mining industry continues to expand on a colossal scale.

British Columbia yields 93 per cent of all the lead and 88 per cent of all the zinc produced in Canada. Its quota of silver is 38 per cent and of copper, 65 per cent. A large area, estimated at 200,000 square miles, in the province remains practically virgin, and therefore invites prospecting.

Lamenting the "Old-Time" Prospector

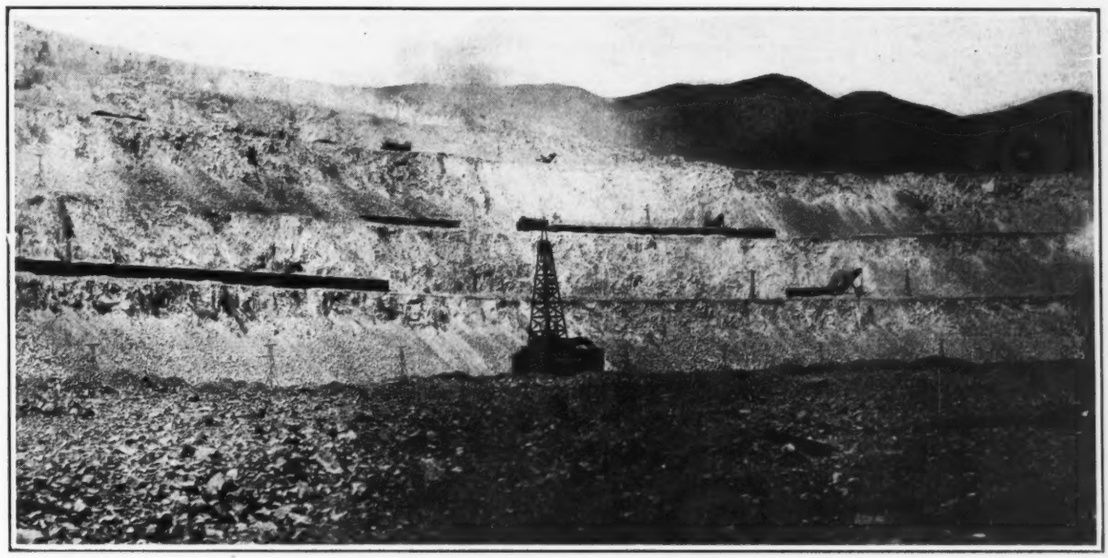
Unfortunately, the old type of prospector is disappearing, and organized efforts have to be made to encourage exploratory work by giving tuition in mineralogy and geology at mining schools and in night classes. Even these aids seem insufficiently stimulating, and the reason is not far to seek: the prospector's reward is not what it used to be, when discoveries or prospects were bought, like a pig in a poke, without careful examination or preliminary work. Formerly, the prospector might get a small fortune suddenly, because his finds were bought eagerly and carelessly; nowadays investigation and actual digging under option precede the passing of any large sum of money. Moreover, the scientific methods of exploration, by geologic investigation and the use of electrical ore-finding apparatus, are giving a new aspect to the search for mineral deposits. Such methods should impart further vigor to mining in British Columbia.

It would be remiss on my part to leave the subject without referring to the recent death of William Sloan, for twelve years Minister of Mines for British Columbia. He was pre-eminently safe and sound, and for that reason perhaps he always took a keen interest in the application of safety methods in mining, especially in the collieries. As administrator in the province he was friendly to American operators, realizing the helpful effect of the capital that came from the south of the border for the stimulation of the industry. This sensible, and amiable, policy is likely to be continued.

Since the foregoing was written a general election in the province has brought the Conservative party into power, and Mr. W. A. McKenzie has become Minister of Mines. He has taken an early opportunity to announce his determination to check fraudulent operations in mining shares. "At no time," he says, "have such measures been so necessary as they are now on account of the present activity in the mining industry . . . The dishonest operator is an enemy not only to the investing public but to the mining industry as well; when an investor is deceived and loses money in a dishonest promotion he is inclined to become skeptical about the whole industry and to withdraw his financial support." To this nobody will demur, and it is well for the Minister to take a strong stand in the matter; he has instructed the resident engineers in the government service to keep an eye on questionable enterprises and to furnish corrective information to the public. However, one remark may be made, even if I have made it more than once before, and that is that the public has lost more money by the overvaluation of rich mines than by speculating in poor prospects or fraudulent schemes.

Sampling Churn-Drill Sludge at the Utah Copper Mine

By L. S. Breckon
Geologist, Utah Copper Company, Bingham, Utah



Open cut at mine of Utah Copper Company

When ore and waste rock are differentiated from one another by a margin of only a few hundredths of 1 per cent of metallic content, special methods of exploration and sampling must be employed, if subsequent mining operations are to be intelligently planned. Conditions of this character prevail at the large open-cut mine of the Utah Copper Company, situated in Bingham Canyon, Utah.

Two types of churn drills are used in prospecting the monzonite porphyry orebody: the Star gasoline-driven rig for holes to a depth of 800 ft., and for deeper holes the Standard oil rig using electric power. The latter rig has proved very satisfactory at the property. A derrick 75 to 80 ft. high, with a base 20 ft. square, is used on all the ridge. Because of the long string of tools required to drill to a depth below 1,000 ft., a derrick of this height is required; otherwise it would be impossible to handle the tools with ease. The string of tools comprises a drilling bit, an auger stem, jars, a sinker bar, and a rope socket.

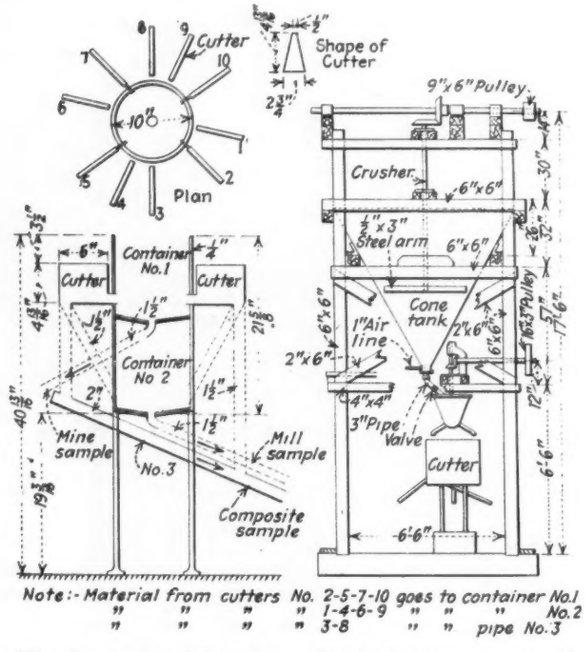
Start Holes With 26-In. Casing

As most of the holes are drilled on the benches of the mine through material slightly loosened by blasting, they have to be of large diameter when spudded. Generally a 26-in. bit is used for this purpose, and a 26-in. stovepipe casing is carried down 80 or 100 ft., depending on the extent to which the ground caves. At this point a 23-in. stovepipe casing is inserted, and carried down as far as possible—that is, until a cave "freezes" it. Reaming, to allow the casing to go to a greater depth, is commonly resorted to when the casing will not follow the bit. It is not desirable to have an open hole more than 40 ft. below the bottom of the casing, as considerable caving always takes place in an uncased hole, and this has a tendency to make the sampling unreliable. The ideal procedure would be to drill 5 ft., and then drive the casing to the bottom of the hole before drilling deeper, but this would be too expensive, on account of the delay occasioned in changing from the drilling tools to the reaming tools, and vice versa. Forty feet of uncased hole, however, is the maximum drilling interval, if accurate samples are to be obtained.

Sampling at the churn drills is under the supervision of the geological department, and the sampler assigned to each rig is directly responsible to the company geologist. As samples are taken every 5 ft., the sampler is continuously occupied in taking, drying, sacking, and marking samples, and in cleaning launders, splitters, tubs, and sampling machine after each sample is obtained. A card is placed in each sample sack, showing the date the sample was taken, the number of the sample, the depth of hole, and the number of the hole.

After 5 ft. is drilled, the tools are taken out, and either

a dart or suction bailer is used to remove the sludge from the hole. The suction bailer is preferred in this work, as it removes all the fines that may have collected at the bottom of the hole during the drilling operation. As the fines carry a large portion of the valuable metallic materials, it is essential that they be removed to obtain a true sample of the depth that has been drilled. Twelve bailings may be necessary to remove all the sludge in a wet hole, whereas five or six would be sufficient in a dry hole. This procedure is carefully watched by the



Fig, 1, on the right, shows Utah Copper Company's churn-drill sampler. Fig. 2, on the left, is the company's cutter for churn-drill sampler.

sampler, and his reports show the number of bailings made to obtain each sample.

Sludge from the bailer is discharged into a launder, 2 ft. square in cross-section, which is constructed close to the drill hole, and which leads to the sampling appliance shown in Fig. 1. This launder is never more than 65 to 80 ft. long, and is built on a 6 per cent grade to insure free passage of the sludge to the sampling machine. At the end of the launder is a screen, 8 to 10 ft. long, through which the fines pass directly into the cone-shaped tank of the machine. The coarse material goes over the screen to a small gyratory crusher, where it is crushed before falling into the cone-shaped tank. Sludge in the tank is agitated for twenty minutes by a mechanical agitator that revolves near the bottom, and also by compressed air under 70-lb. pressure that enters through a 1-in. line near the bottom. By means of these two methods of agitation, the sludge is thoroughly mixed before being allowed to pass out through a valve at the bottom into two revolving pipes, or distributers, that convey it to the split divider shown in Fig. 2. This divider is constructed so that three separate samples can be obtained from the same sludge.

The divider has ten openings, over which the distributers pass, and the size of the samples can be cut to any desired proportion by opening or closing the divider openings. Thus, if a 26-in. hole was being drilled, one opening would be left open to give a sample of about 25 lb., and if a 10-in. hole was being drilled, three openings, probably, would be left open to obtain the same weight of sample. Construction and arrangement of the divider is simple; four openings that lead to the hopper for one sample are in the form of a cross; the second sample is obtained from another cross that leads into a separate hopper equipped with a 2-in. pipe discharging into an outside tub; the third sample, somewhat smaller in bulk than the other two, is taken from two other openings.

Careful Duplication of Assays

Three separate samples are thus obtained from the same pulp. One is sent to the mine assay office for analysis, one to the assay office at the mills, and the smaller sample from the two openings is cut down to 5 lb. by means of the splitter shown in Fig. 3. This sample is then placed in a 5 gal. wet sample can to furnish a composite sample of every 100 ft. driven and to serve as a check on the individual 5-ft. samples. It is also used occasionally for making experimental flotation tests.

Samples for the assay offices at the mine and mills are caught in tubs, and thoroughly dried, without burning, on a large sheet-iron stove kept at the sampling device. They are then sacked and tagged for their respective destinations. As all the sampling and quartering of the sample are done mechanically, there should not be any variation in the analyses of the two samples obtained. A 2-lb. specimen is saved of every 25-ft. of hole drilled in the porphyry, and of every 5 ft. when the hole is near the contact of the porphyry and quartzite. These specimens are examined by the geologist to determine the minerals contained and the character of the rock through which the hole is drilled.

A daily report is prepared by the sampler, showing all facts that might be of importance in keeping a complete record of the hole. A log of each hole is made by the geological department. This log includes the casing record, copper and iron assays, character and minerals of the rock, faults encountered, delays at the drills, points of caving of the hole, and any other information that may have a bearing on the orebody. Besides this, a record of the assay returns from the mine and mills is kept, and, when there is a variation of over 0.05 per cent copper between the mine and mill assays, duplicate analyses are made of the pulp. The duplicate assays are then averaged, and the average is used as the final grade.

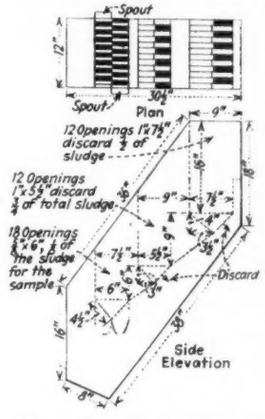


Fig. 3—Utah Copper Company's splitter

The procedure described in the foregoing has proved very satisfactory in sampling the low-grade porphyry orebody, as all cutting of samples is done mechanically, and the human element involved is reduced to a minimum. It has been found that unsatisfactory returns are obtained from the two pulps analyzed if the quartering is done by hand. As a few hundredths of 1 per cent difference in the copper content of the assays differentiates between ore and waste in the disseminated copper deposit, every possible precaution is taken to obtain accurate samples.

Copper Smelting at Douglas

Part XVI: Revisiting Arizona Mining Camps

By E. H. ROBIE
Associate Editor

MY LAST ARTICLE was devoted to a brief survey of the practice at the Morenci mill of the Phelps Dodge Corporation. I had intended spending a half day or so at the Clifton works also, where the Morenci concentrates are smelted, but circumstances dictated otherwise, and I had the opportunity for only a hasty view of what is going on there, and a hurried chat with I. J. Simcox, the smelter superintendent, and his assistant, J. G. Lindley.

The Clifton smelter, until recently anyway, has followed the practice of the other Southwestern plants, carrying on roasting in multiple-hearth furnaces, reverberatory smelting, converting, and shipping of the blister copper to the refinery. In the last year or so, however, some interesting work has been done looking toward the casting of copper anodes, thus making unnecessary the reheating and poling ordinarily done at the refinery. Casting of copper anodes at the smelter has been successfully accomplished for some years at the El Paso plant of the A. S. & R., but not on the scale nor with the refinements proposed here.

Inasmuch as the Clifton smelter is entirely dependent on the Morenci operations for ore, the tonnage smelted is limited by the amount of concentrates available. At the time of my visit, last spring, 370 tons a day was an average charge, a 50 per cent matte being made, rather higher than is usual at other plants. The comparatively low tonnage smelted results in a somewhat higher fuel ratio, about 0.46 bbl. of oil per ton being required. The furnace is constructed with the Siemens angle, as described in the Siemens patent of which we have heard much in the Carson litigation.

As I have already intimated, the anode furnace is of the most interest here, but as experimental work is still going on, and was, at the time of my visit, it would not be advisable to give details. Briefly, the practice consists in transferring the molten copper from a converter to a cylindrical tilting anode furnace, insulated with Sil-o-cel brick to minimize heat losses. There it is blown for an hour with air, and the charge, which consists of about fifteen tons, is then poled for an hour or an hour and a half as in ordinary refinery prectice. About four green poles are used for this purpose. It is then poured into anode molds and cooled for five minutes; then loaded into cars. Particular care is taken to minimize handling charges throughout, Baker electric trucks being used for the final step of removing the anodes to the cars.

My stay at Clifton was cut short by the opportunity of traveling to Douglas with William B. Cramer, consulting engineer of the Phelps Dodge concentrating department, in his new Ford sport coupé. At that time, the new Ford was a novelty not to be ignored by those who take pleasure in being among the first to do things—and who does not? I can speak in the highest terms of its riding qualities and its hill-climbing ability. It will come as a pleasant relief to the millions who have become inured to the task of pushing their old Fords up long grades with the left. foot. We climbed out of Clifton late in the afternoon and arrived at Lordsburg, some 70 miles, in time for a late supper. Nat Gammon, the genial proprietor of the Hollen Hotel, saw that we had good rooms, but we arose at 5:30 and were on our way to Douglas in three-quarters of an hour, the early morning being a delightful time to tour in Arizona. The "Sleeping Indian," that startling likeness fashioned by Nature emblematic of the vanishing race that once made its home here in the desert, was clearly visible on the distant horizon for miles. Past the "Elephant's tooth," a sharp rocky peak on the right of the road, we went, and saw the entrance to Cave Creek Canyon, one of the scenic spots of southern Arizona. Then we paralleled the tracks of the Southern Pacific, taking an occasional short-cut, and soon was spread out before us the level plain on which Douglas is situated. Its group of smelter stacks, belching into the atmosphere all the sulphur contained in the Bisbee ores, makes a distinguishing landmark. At 9:40, after a hundred mile ride, I alighted at the Palomar Hotel, the well-known Gadsden having burned only a few weeks before. Another large hotel will no doubt soon be provided.

J. Owen Ambler

J. Owen Ambler, who was formerly in charge of the Clifton smelter, is now superintendent of the Copper Queen smelter at Douglas, and appeared to be, at least, the willing victim of a Saturday afternoon visitor. Great things have been going on at this plant, most of which are known, in a general way, to my readers. The largest roasting furnaces in the world, superimposed on the reverberatories; red-hot calcines to the charge hoppers, with enormous reverb capacities, and low fuel ratios; these things have been bruited about by word of mouth wherever smelter men have met, and have been casually referred to in the technical press. I regret that the time is not yet ripe to give details, for Mr. Ambler and his cohorts feel that the installation is still an experimental one, and that, until the practice is standardized, publication is unwise. I must beg the reader's pardon, therefore, if the title at the head of this article has led him to expect something that he will not find. And yet, per-

haps in a few words, I can give some idea of what is going on.

As is generally known, the new Phelps Dodge smelter consists of two units, each provided with a 26 ft. 9 in. x 96 ft. (outside) reverberatory furnace on which six 19-ft. diameter, eleven-hearth roasting furnaces are superimposed. New Cottrell equipment and a new stack were also provided, but the old converter shells remain. The blast furnaces are no longer used for copper smelting.

The charge to the roasting furnaces, consisting of about 35 per cent concentrates, 60 per cent direct-smelting ore, and 5 per cent byproducts, is hoisted to the roaster-feed bins by an inclined conveyor belt. No new bedding system has so far been adopted, though it is possible that one may be put in before long, as it is felt that it would facilitate the securing of a homogeneous charge. Also, as an aid in this respect, it is felt that all ore should be crushed to pass 4 mesh; with only 60 to 65 per cent through 4 mesh, as it was at the time of my visit, there is a certain amount of segregation of the charge.

Roaster Plant Is Unique

The furnaces have eleven interior hearths, being the first anywhere in the world to be so generously provided for in this respect. Seven is the usual number, though a nine-hearth furnace has been used for some time at Douglas. It was thought necessary to have exceptional roaster capacity here to take care of the reverberatory immediately beneath, but as each roaster has a capacity of 280 to 300 tons a day, and there are six of them over each reverb, it is obvious that not all of them are required even for the large tonnage—about 1,100 tons or more of dry roaster feed—that each of these furnaces is capable of smelting. The roasters have unusually large drop-holes, for it is while dropping from one hearth to the next that most of the oxidation is accomplished. Brown electric pyrometers are permanently installed on the lower hearth of each roaster, so that any drop in temperature can be instantly localized. Heat conservation is considered decidedly important here, to get a maximum tonnage through the reverberatories. To this end a Sil-o-cel insulating layer surrounds each furnace; also, the flues and Cottrell precipitator are insulated to prevent the temperature of the effluent gases from dropping below the condensation temperature of sulphuric acid, and thus attacking the steel walls of the flues. A spherical valve in the large pipes carrying flue dust in the roaster building affords a convenient means for the release of this dust into the hoppers beneath. This brief reference to some of the details about the "Queen" roaster plant will give some idea of the novelty in design, for which the local operators are responsible. The actual building of the roasting furnaces was intrusted to the Pacific Foundry Company, in San Francisco.

The large drop holes and the high furnace capacity result in perhaps more than the usual amount of flue dust. This is caught in a Cottrell, but it apparently would have been advisable to install a balloon flue ahead of the Cottrell. Some difficulty was experienced at first with inadequate rapping of the pipes in the precipitator, but this has now been remedied by a pneumatic device.

The hot calcine drops from the roasters directly into small reverberatory feed bins, from which it enters the furnace. Considerable experimentation has been necessary here to secure the desired results; less trouble would have resulted had the bins been built lower, but pioneers cannot expect perfection at once. The furnace is charged for the first 60 ft. from the bridge wall only; it is 32 ft. further on to the skimming bay at the end of the furnace. Skimming is almost continuous—fully seven hours out of eight. Tapping is performed through the bridge wall, another unusual feature of practice at the Copper Queen smelter.

The furnace has a straight arch, without the ribs that I spoke of at Clarkdale. They have been proved unsuccessful both here and at Cananea, the brick burning out up into the ribs. The ten oil burners are arched, those at the center being lower down than those at the ends, thus making the shape of the bed of flame conform to the way the charge lies in the interior of the furnace. The flame extends into the furnace about 18 ft., the brick arch overhead requiring repairs at intervals of about three months. Four 520-hp. boilers are installed in the flue from each furnace.

There are two reverberatory units in use, or were early last spring, making about 11,000,000 lb. of copper per month. The matte averages 35 per cent; and the slag, copper 0.44, silica 37 to 38, alumina 9 to 10, and lime about 2 per cent. The converter slag, which is charged molten to the reverberatories according to the usual custom, contains from 24 to 26 per cent silica.

An explosion while cleaning out one of the reverbs occurred shortly before my visit, and as it illustrates a hazard that no doubt occurs elsewhere, I think it well to bring the matter before other smelter operators. It is common practice, when shutting a reverberatory down for repairs, to tap out as much matte as possible, and then to play a stream of water on the crust in the furnace to cool it down quickly so that work on the arch can go on. When this was being done here, there was a sudden explosion, which, fortunately, had no fatal results, but which was more or less terrifying, not only on account of the noise and flying débris, but because every particle of dust in the building was loosened, much of it floating about in the air for a time. Apparently the stream of water being used had found a pool of molten matte under the crust, the explosion being a logical eventuality. Hereafter, the Copper Queen will use a spray of water instead of a heavy stream, and take care that no more is added than will evaporate at once.

No Change Made in Converters

As I mentioned before, the old converters are still being used here. These are of the Great Falls type, 12 ft. in diameter, though I surmise that the Peirce-Smith type would be installed if the plant were being built anew. There are nine stands, though only four or five shells are used at a time. Each converter has 22 tuyères of 1½-in. extra-heavy pipe construction, though a 1-in. hole is about as large as can be kept open. Air pressure is about 11 lb., a pound or so lower than is usual, and probably not quite so satisfactory as the more common practice.

This, I realize, is an inadequate account of present Copper Queen operations, but I hope that, within a year, practice will have been sufficiently perfected so that a full description may be published. In the meantime, I can assure my readers that the novelty and efficiency of practice here makes it one of the most interesting smelters to visit. The idea of the superimposed roasters is particularly important. Conditions here, of course, are not favorable to the feeding of an unroasted charge direct to the reverberatory, as is done at Cananea and at the International Smelter at Miami.

The lead smelter, which was blown in about a year ago, is the first lead smelter in Arizona, at least in recent years, but is of secondary interest only. It consists essentially of one Dwight & Lloyd sintering machine, one nine-hearth Queen roaster, a blast furnace and a small basic lined converter. The charge is finer than was expected, owing to the large proportion of flotation concentrate received, so that the capacity of the sintering machine is limited to about 200 tons a day. Malleable iron grates, with ¼-in. slots, are used. At the time of my visit about 160 tons of material was being charged a day, sulphur being reduced in the sintering operation from 11 or 12 per cent to 2 or 2½ per cent. About half of the charge was direct-smelting ore and half concentrates.

The blast-furnace feed is assembled in an electrically driven charge car made by the Atlas Car & Manufacturing Company, in which each ingredient is weighed to the nearest ten pounds; included in the charge are coarse direct-smelting ore, sinter, lime or iron flux, and coke. Dross and other reverts are shoveled in by hand. Lead is periodically tapped from the lead well, through the side of the furnace, into small pots, which are subsequently dumped into one of two oil-fired 50-ton kettles. The impurities are drossed by blowing air into the bullion, the dross being recharged to the blast furnace; the purified bullion is cast into 95-lb. pigs for the Balbach refinery at Newark, N. J., to which it is shipped. The stream of matte and slag, tapped periodically through a breast jacket at the end of the furnace, runs through two settlers, the settled matte being cast for subsequent roasting and smelting and the slag going to the dump. It contains about 5 per cent zinc.

Liberal provision is made for catching all dust, fume, and deleterious gases arising from the various operations. A Lynch dust filter, in which the dust-laden air from the crushing and sampling department is passed through a tank containing crushed ore, is a feature, an 85 per cent extraction of the solid particles in the air thereby being secured. A large dust chamber and baghouse are used for the recovery of the dust and fume.

The matte from the regular furnace runs is allowed to accumulate until there is sufficient to warrant putting the furnace on a special matte-smelting charge. The matte is roasted in the nine-hearth Queen furnace, mixed with other ore and flux, sintered, and charged to the furnace, the resultant matte containing about 35 per cent of copper and 10 to 12 per cent of lead. For converting this matte to white metal, and volatilizing the lead and sulphur, what I believe is the world's smallest basic-lined converter has been provided. I did not see it in operation, but I understand that it is a success. Being only 5 ft. long and 5 ft. in diameter, it is a veritable watchcharm compared with its big brothers in the copper smelters to which its product goes.

The Calumet & Arizona Reduction Plant at Douglas

Though one hears more about the Phelps Dodge smelter at Douglas than about that of the Calumet & Arizona Mining Company, which occupies an adjoining site, the C. & A. plant is but little less important from a production standpoint and has some features not possessed by the other. At the time of my visit, the Copper Queen was turning out about 11,000,000 lb. of copper per month, and its neighbor about 9,500,000 lb., of which 5,000,000 came from concentrates shipped from the New Cornelia property at Ajo, and 4,500,000 lb. from the direct-smelting ore produced by the company's own mines at Bisbee together with lease and purchased ores.

The Calumet & Arizona plant was partially remodeled about four years ago, at which time a particularly fine crushing plant was constructed, which is still a model of its kind. A Cottrell precipitation unit for the smelter gases was also installed then, costing less than $200,000, which Carl Cole, metallurgist at this plant, told me was the best investment that the company ever made. It is unusual for a plant to depend so largely on direct-smelting ore in these days of flotation concentration of low-grade ore, but the Calumet & Arizona is fortunate in having a high-grade mine, the copper content of the ore shipped being about 5 per cent. In the Campbell orebody, now being developed, assays of 7 to 8 per cent are reported, so there seems little likelihood that the company will be forced to adopt concentration. Formerly, the major part of direct-smelting ores was smelted in the blast furnaces, but with the large decrease in oxide ore the more efficient reverberatory smelting became practicable. During the last seven years reverberatories have been used exclusively.

Carl Cole

The run-of-mine ore is first dumped in bins, from which it passes to one of two gyratory crushers, these having displaced the jaw crushers formerly used. Hummer screens then remove the undersize, after which 78x24-in. rolls complete the crushing to ½ in. The roll practice is exceptionally good here. By choke feeding, a fine and uniform product is secured. Corrugations are obviated by interchanging, from time to time, the primary and secondary rolls. The primary or coarse-crushing operation produces shell corrugations which are worn off by placing the roll on the secondary or fine-crushing operation. A roll shell (cast-steel shells made by the Columbia Steel Company are used) is 9 in. thick when first installed, but wears down to about 1 in., in which time it crushes about 300,000 tons of ore. A steel efficiency of from 87 to 92 per cent is thus secured. All of the crushed ore, plus the concentrates, is bedded, and the smelter charge taken up with Messiter reclaimers.

A new sample-grinding building is worthy of note. High- and low-grade ore are kept on separate sides of the building, respectively, and the equipment throughout is of the most modern type. The riffle samplers follow the design that was first developed at this plant, I believe, one being placed above another, and all inclosed in a cabinet. Movable sample cutters are mounted on a single shaft. Drying is all done by steam.

The Herreshoff type of roasting furnace is used here, there being 24 furnaces, each 21 ft. 6 in. inside diameter, with six roasting hearths and one drying hearth. The daily tonnage has been stepped up to about 150, the sulphur content being reduced from 22 to about 12 per cent. Some of the furnaces, however, which make a gas used in the acid plant, will average only 75 tons per day, but they handle a higher-grade ore, roasting down from 35 to 12 per cent sulphur. These operate at a higher temperature, and the upper hearths are under pressure. Also, some roaster gas, containing about 5 per cent of sulphur dioxide, is supplied to an adjacent plant of the Apache Powder Company for making about 20 tons per day of oleum or fuming sulphuric acid. Low-temperature gas

is required for this purpose. The C. & A. chamber acid plant makes about 200 tons of acid per day, 50 of which is used at Ajo, and 150 by the Inspiration leaching plant described in an earlier article.

The roaster gas is cleaned in a 500,000-cu.ft. Cottreli plant of the plate and rod type, built in five sections. About 4 or 5 per cent of the charge to the roasters is thereby recovered, but the precipitated dust contains 22 to 23 per cent of copper, or about twice as much as the ore that is being roasted. A clearance of better than 95 per cent is obtained, the only fume getting by being siliceous material that contains 2 or 3 per cent copper. The plates in the treater are spaced 5 in. apart, with $\frac{5}{8}$-in. twisted iron rods suspended at 6-in. intervals between them. This is somewhat less spacing between the plates than is usual, I believe, and, of course, requires a somewhat lower voltage, 30,000 volts being maintained.

Trouble at first arose from the rapping system, which caused some bad leaks. Mechanical rappers now operate every hour and are entirely satisfactory. At such times the rear baffles of each section are closed. About 60 tons of dust is collected each day in the Cottrell precipitator, and from 25 to 30 in the balloon flue through which the gases pass directly after leaving the roasters.

The C. & A. Reverberatory Plant

Four 19x100-ft. reverberatories, equipped for side charging, are available, three being in use at the time I was there, which was St. Patrick's Day. These each have a capacity of about 700 tons of solid charge a day, using about 0.52 bbl. of oil per ton, blown in with 2-lb. air. The charge is fed over about half of the length of the furnace. Every 70 to 90 days the back section of the roof arch, extending about 20 ft. from the burners, is repaired. The arch extends straight to the flue. An attempt is made at continuous skimming, but this operation goes on only about half the time. Matte assays average from 30 to 32 per cent copper, and the reverb slag contains about 0.41 per cent copper and 47 per cent silica plus alumina. The converter slag, which is poured into the reverbs in the molten condition in the usual way, runs 22 or 23 per cent silica, but it is felt that the reverb slag loss would be improved if it were higher—say, 30 per cent—which could be more easily accomplished with the horizontal type of converter instead of the Great Falls type which is installed. Five such converters are used, with one held as a spare.

With the favorable ore developments at Bisbee and Ajo, it seems probable that the time is not far distant when George Dawe, who is smelter superintendent here, and Carl H. Cole, metallurgist, will have to plan on a little more equipment, for the present capacity of the plant is being pretty well utilized.

The two smelters that I have discussed so briefly are excellent examples of modern American practice, and the itinerant copper metallurgist must, of course, plan to stop for a couple of days at Douglas. There is little else in the town to interest one, however. If one wishes to go abroad, frequent taxi service is maintained to Agua Prieta, the Mexican border town a mile or so to the south, but this is a sorry place to visit, with its numerous little vegetable and meat shops and cheap cafés. There is the Club Sociale, of course, which I presume is a lively enough place on occasion, but I believe this is not open to the public. Unless one has his own party, with which he can assure himself of a good time, he had better stay in Douglas and go to bed early.

Overproduction Affects Gypsum Industry Adversely

A SMALLER DEMAND for gypsum products in building materials in 1927 was accompanied by record domestic production. The result of these factors has been a decline in prices, and excessive competition, resulting in an appreciable reduction in earnings of many of the companies engaged in the production and preparation of gypsum products. The foregoing opinion appears in the review of gypsum in "Mineral Industry." Further data given by W. H. Myers, the author of the review, are as follows:

An important development in gypsum technology is the introduction of a special gypsum board, which is replacing wood lath in house construction. A lightweight gypsum flake of large bulk has also been introduced for use as an insulator in house construction. "Gyplap," a gypsum sheathing to replace wood sheathing and building paper, is another recent development. A continuation of the investigation into the suitability of gypsum-anhydrite mixtures as retarders in the manufacture of portland cement has shown excellent results. Continued low prices for gypsum are predicted, and Mr. Myers expects the industry to meet the situation by eliminating the high cost producers, the merging of many small companies.

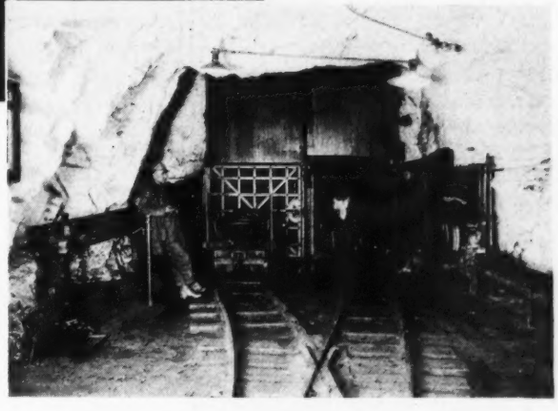
Sand and Gravel Production Continues to Increase

PRODUCTION of sand and gravel in the United States in 1927 amounted to 197,454,269 tons, valued at $115,529,786, according to the U. S. Bureau of Mines—an increase of 8 per cent in quantity and of 4 per cent in value compared with the large output of 1926. Sand production was 93,588,339 tons, valued at $54,291,398; gravel production was 103,865,930 tons, valued at $61,238,388.

New York led the states in sand and gravel production, with 19,896,766 tons, valued at $12,157,612. Illinois was second, its output amounting to 19,328,703 tons, valued at $9,166,934, and Michigan was third, with 15,419,499 tons, valued at $7,800,541. About 76 per cent of the total production of sand and gravel was reported as washed and screened.

Chile Establishes a Mining Bank

THE PROBLEM of providing financial aid for the development of meritorious prospects and the provision of facilities for the milling and smelting of ores is one that has received government attention in the Republic of Chile. As a result, a Mining Bank, or Caja re Crédito Miñero, with a capital of one million pounds sterling, has been created. An account of its formation and functions, with pertinent comment as to the situation it is expected to relieve, will be presented soon in the form of an article by Mr. Fernando Benitez.



Steel Shaft Sets On the Gogebic Iron Range

By A. L. Foss

Chief Engineer, Castile Mining Company, Ramsay, Mich.

To the left is the steel headframe, 168 ft. high, of the Eureka mine of the Castile Mining Company, Ramsay, Mich. The 22d level station at the mine is shown below.

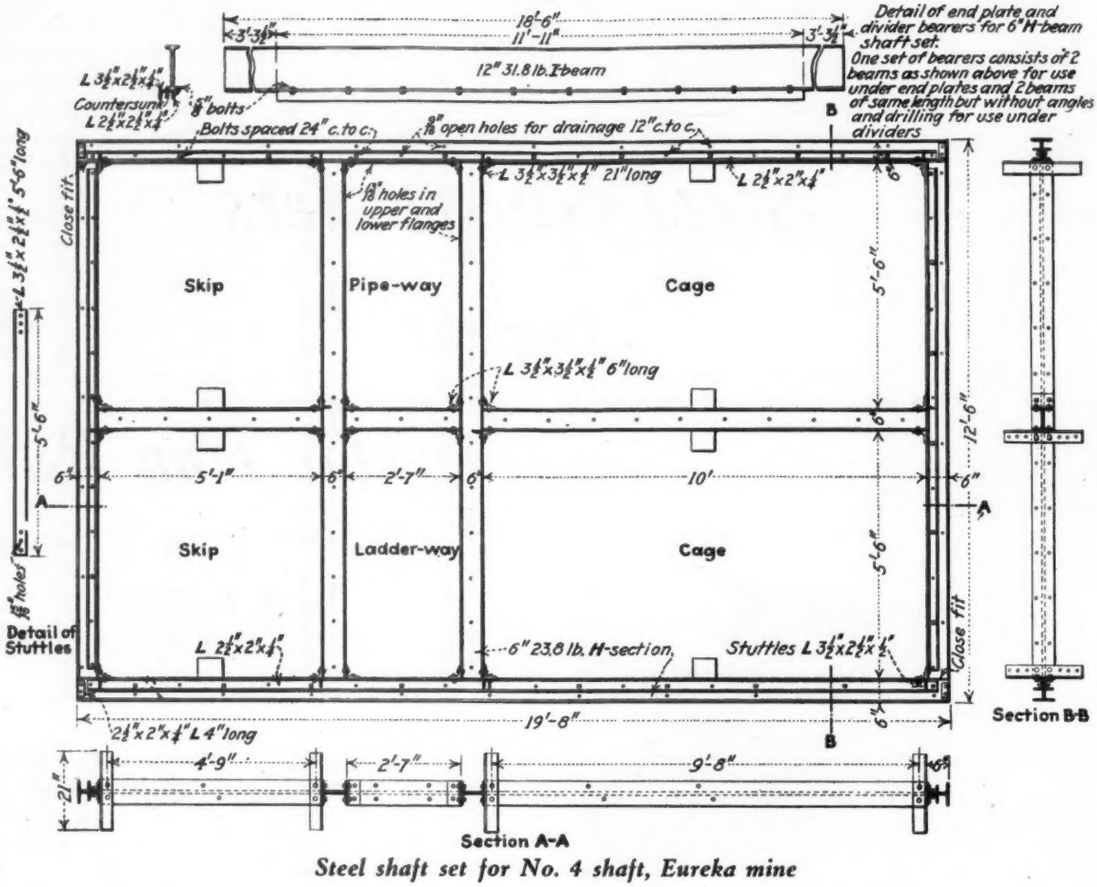
THE use of steel for shaft sets has been a standard practice on the Gogebic iron range, in Michigan, for many years. In fact, the only shafts sunk in the last twenty years in which wooden sets were used have been small prospect shafts. During this period about twelve large operating shafts have been sunk to depths of approximately 2,000 ft., all of which have been lined with steel sets. In recent years the tendency has been to eliminate the use of wood almost entirely, so as to make the shafts fireproof and to reduce the cost of upkeep to a minimum.

The following is a description of a large steel and concrete-lined shaft, sunk by the Castile Mining Company at Ramsay, Mich., which is representative of the present standard method of shaft construction in this district. This shaft was started in 1923 and was completed two years later to a depth of 2,207 ft. The outside dimensions of the shaft sets are 12 ft. 6 in. by 19 ft. 8 in. The shaft is vertical and has six compartments, two skip roads, two cage roads, a ladder road, and a pipeway. In this shaft the sets are constructed of 6-in. H-beams which weigh 23.8 lb. per foot and are installed at 6-ft. centers. Studdles used are of $2\frac{1}{2}$x$3\frac{1}{2}$x$\frac{1}{2}$-in. angle iron, twelve of these being used on each set of steel. The end plates are attached to the wall plates by a vertical 3x$3\frac{1}{2}$x$\frac{1}{2}$x21 in. angle iron on the inside corner. One leg of the angle is bolted to the end plate and the other leg riveted to the wall plate. The angle iron at the corners protrudes $7\frac{1}{2}$ in. above and below the H-beam, and to these ends the studdles are bolted. The angles thus serve two purposes. Attachment of a divider to the wall plate is accomplished similarly, except that there is an angle on each side of the divider, one of which is 6 in. long, and the other 21 in. in length, the latter serving to attach studdles. At the junction of two dividers three 6x3x3-in. angles are used in the corners and one 21-in. angle, the latter also serving to attach studdles.

As this shaft was intended to be fireproof, the only wood used was for the guides and temporary blocking while installing sets. Reinforced-concrete lath or lagging was used for the entire length of the shaft. The lath were made the shape of a plank, $2\frac{1}{2}$ in. x $8\frac{1}{2}$ in. x 5 ft. 11 in., 90 pieces of these being required to lag up a set of steel. Instead of being installed outside the H-beams, the lath were installed between the flanges with the butts against the web. To hold the lath against the outside flange of the H-beam, it was necessary to attach a small angle to the web of the H-beam for this purpose. Key lath, $2\frac{1}{2}$ in. shorter than the others, were required in the center of the wall plates and end plates in order to lath the sides in tight. The lower ends of the key lath rest on a short block. The concrete lath are reinforced by six $\frac{1}{4}$-in. iron rods, laid lengthways. Between main levels in the shaft the ladder road is boxed in with reinforced concrete lath which are $\frac{1}{2}$ in. thick. Three $\frac{1}{4}$-in. rods are used for reinforcement in these lath.

Shaft sets are blocked and lined in by means of short wooden blocks and wedges. After the shaft set is thus blocked, cement sacks filled with a wet concrete mix are placed between the steel and the wall rock at various points around the perimeter of the shaft. This constitutes the permanent blocking, and the wooden blocks are allowed to remain as long as they may.

Bearing pieces, installed at irregular intervals whenever needed, consisted of heavy I-beams laid parallel to the end plates, and were firmly hitched and concreted in the wall rock.



Steel shaft set for No. 4 shaft, Eureka mine

The steel for this shaft was fabricated partly by the American Bridge Company and partly by the Worden-Allen Company, of Chicago. All attachments of angles to the wall plates and dividers which it was not necessary to make during installation were riveted at the factory. This simplified the work of installation and possessed the additional advantage that it required no additional work at the mine shop.

Soviet Gold Production Shows Steady Increase

THE SOVIET gold industry is undergoing a drastic reorganization which is expected to result in greatly increased gold production. Gold output since the inauguration of the Soviet régime, although increasing at a substantial rate after the decline of 1919-21, has been hampered by lack of modern machinery.

Production of gold in the U.S.S.R. is inadequate to meet the needs of the country. Soviet gold reserves, in the Urals, the Caucasus and in Siberia, have been little explored. Proof of this is furnished by the discovery five years ago of gold in the Aldan region of Siberia, from which 30,000 kilograms has since been obtained. There is justification to warrant exploitation with dredges, but antiquated methods would not pay.

The government decided to consolidate individual gold producers, with the exception, of course, of the concession companies, into one large company—the Soyuz-Zoloto—which will be able to organize the industry and introduce modern methods of prospecting and production. The total Soviet gold production for the current year is expected to reach 37,750 kilograms, as against 23,152 kilograms in 1926-27.

To increase production and to lay the foundation for a greater output in the next few years the Soyuz-Zoloto has been allotted by the government a total of 21,500,000 rubles (about $11,000,000). The distribution of the funds allotted to Soyuz-Zoloto was as follows:

	Rubles
Expenditures on new production units, including equipment	11,964,400
Re-equipment and expansion of existing production units	5,119,100
Capital repairs	1,065,500
Various expenditures for capital construction	1,213,500
Opening of new gold regions	1,150,000
Re-equipment of refining plants	250,000
Road building, etc.	737,500
Total	21,500,000

Of the above total, nearly 4,000,000 rubles was assigned for geological prospecting. The Soyuz-Zoloto, which favors the introduction of the California-type gold dredge, rather than the lighter dredge of the New Zealand type, expects to complete soon the installation of three new electric dredges in the Far Eastern region, two of 7½ ft. each, and one of 13½ ft. In addition, five 7½-ft. electric dredges are to be ordered and installed for the Aldan, Yenisei, and Ural gold regions. Thirteen hydraulic installations were to be completed this year in various sections of western Siberia as well as 17 refining plants and 9 chemical plants for the treating of gold ores. Out of the total of $11,000,000 about $2,000,000 was to be spent this year on new equipment, the purchases to be made largely in the United States and Germany.

USEFUL OPERATING IDEAS

Specific Gravity Indicators

C. F. SPAULDING
Kansas City, Mo.

IDEA No. 1

TWO specific-gravity indicators that will function continuously and need no attention except the occasional addition of a few crystals or drops of permanganate solution to maintain the red color are shown in the accompanying cuts (the red color is not essential, but it makes it easier to read the height of the column of liquid in the glass tube). They will give more accurate readings and give them more quickly and easily than can be obtained by dipping up a bucket of pulp from the tank and determining the specific gravity by means of a flask or by weighing a known volume of the pulp. In making specific-gravity determinations there is always a question in my mind if I have the same density of pulp in the specific-gravity flask as in the tank. It is a mean, disagreeable job at the best, and calls for careful work to get accurate results.

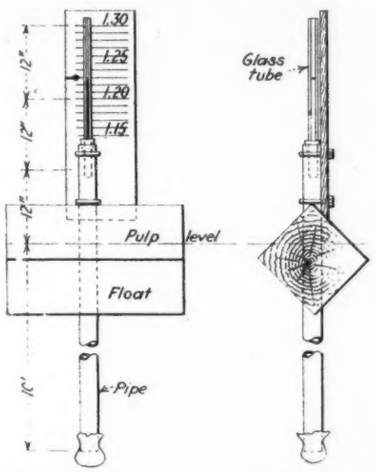


Fig. 1—A floating specific-gravity indicator, for use in tanks

Fig. 1 shows an indicator adapted to float around in a cyanide tank or wherever there is sufficient depth of pulp. It is cheap and can be easily made. It consists essentially of a float large enough to support the apparatus, a piece of pipe of any size from ¾ in. up to 2 in., a piece of ⅜- or ½-in. glass tubing, and a graduated board. The pipe should be 11 to 12 ft. long and adjusted so that its lower end is just 10 ft. below the surface of the pulp in the tank. A piece of filter cloth is tied over the bottom end of the pipe, this to keep clear solution in the pipe. The upper end of the pipe is closed with a cork bored for a ⅜-in. or ½-in. glass tube. Back of the glass tube and supporting it is a graduated board securely fastened to the float. This board is graduated in feet and tenths of a foot, starting at the pulp level mark. The graduation may be limited, if desired, to a few tenths above and below the desired pulp-density mark, or to just one mark or arrow. If the solution in the tube rises above the mark, it shows the pulp to be too dense and to need thinning. If it goes below the mark, the pulp is too thin.

Pulp Density Relations

Computed by H. B. Lowden*

Per Cent Solids	Ratio of Solids to Solution	Specific Gravity of Pulp for Slimes Containing Solids of Different Specific Gravities: 2.50 S.G.	2.60 S.G.	2.70 S.G.	2.80 S.G.	2.90 S.G.	3.00 S.G.	3.10 S.G.	3.20 S.G.
25	1:3.000	1,176	1,182	1,187	1,191	1,195	1,200	1,204	1,208
26	1:2.846	1,185	1,190	1,195	1,201	1,205	1,210	1,214	1,218
27	1:2.704	1,193	1,199	1,205	1,210	1,215	1,220	1,224	1,228
28	1:2.571	1,202	1,209	1,214	1,220	1,224	1,230	1,234	1,239
29	1:2.448	1,211	1,217	1,223	1,229	1,234	1,240	1,244	1,249
30	1:2.333	1,220	1,226	1,233	1,239	1,244	1,250	1,255	1,260
31	1:2.226	1,229	1,236	1,242	1,249	1,255	1,261	1,266	1,271
31	1:2.125	1,238	1,245	1,252	1,259	1,265	1,271	1,277	1,282
33	1:2.030	1,247	1,255	1,262	1,269	1,276	1,282	1,288	1,293
34	1:1.940	1,256	1,264	1,272	1,279	1,287	1,293	1,299	1,305
35	1:1.857	1,266	1,274	1,283	1,290	1,298	1,304	1,310	1,317
36	1:1.778	1,276	1,284	1,293	1,301	1,309	1,316	1,322	1,329
37	1:1.703	1,285	1,295	1,304	1,312	1,320	1,328	1,334	1,341
38	1:1.632	1,295	1,305	1,314	1,323	1,332	1,340	1,346	1,353
39	1:1.564	1,305	1,316	1,326	1,335	1,343	1,351	1,358	1,366
40	1:1.500	1,316	1,326	1,336	1,346	1,355	1,363	1,371	1,379
41	1:1.439	1,326	1,337	1,348	1,357	1,367	1,376	1,384	1,393
42	1:1.381	1,337	1,348	1,359	1,370	1,380	1,389	1,397	1,406
43	1:1.326	1,348	1,359	1,371	1,382	1,392	1,402	1,411	1,419
44	1:1.273	1,359	1,372	1,383	1,395	1,405	1,415	1,425	1,433
45	1:1.222	1,370	1,383	1,395	1,407	1,418	1,429	1,438	1,447
46	1:1.174	1,381	1,395	1,408	1,420	1,432	1,443	1,452	1,462
47	1:1.128	1,393	1,407	1,420	1,433	1,445	1,457	1,467	1,477
48	1:1.083	1,404	1,419	1,433	1,446	1,458	1,471	1,483	1,493
49	1:1.041	1,416	1,431	1,446	1,460	1,473	1,485	1,497	1,508
50	1:1.000	1,429	1,444	1,460	1,473	1,487	1,500	1,512	1,524
51	1:0.961	1,441	1,458	1,473	1,488	1,502	1,515	1,528	1,540
52	1:0.923	1,453	1,471	1,487	1,502	1,517	1,531	1,544	1,556

**Met. & Chem. Eng.*, June, 1912.

The principle on which the apparatus operates is this: a column of clear solution balances a column of pulp of the same weight. Dividing the length of the column of clear solution by the length of the column of pulp gives the specific gravity of the pulp. For example, assuming that a unit cross-section of the clear solution weighs 1 lb. per foot of length and that the specific gravity of the pulp is 1.23, we find that a unit cross-section of the pulp 10 ft. long would weigh 12.3 lb. This would require a column of clear solution weighing 12.3 lb. to counterbalance it. As the clear solution weighs 1 lb. per foot, it would be 12.3 ft. long. Dividing this by 10, the length of the column of pulp, gives a reading of 1.23 specific gravity.

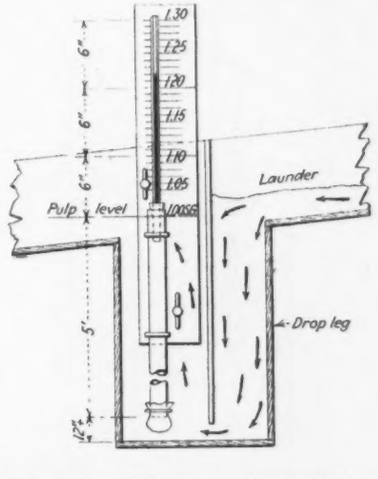


Fig. 2—A specific-gravity indicator for use in launders

Fig. 2 shows an indicator designed to be placed in a

launder where there is 6 ft. or more room below the launder for the drop leg (or it may be bolted to the side of a conditioning tank). The pipe is bolted to the graduated board. The slots in the board will allow for adjustments in height, so that the 1.00 sp.gr. mark can be kept at the level of the pulp.

Almost any convenient length of pipe can be used, from 1 meter to 20 ft. below the level of the pulp, it being borne in mind that the length of the column of clear solution divided by the depth to which the pipe dips into the pulp will give the specific gravity of the pulp. The longer the pipe, the farther apart the graduations will be, and the easier to read.

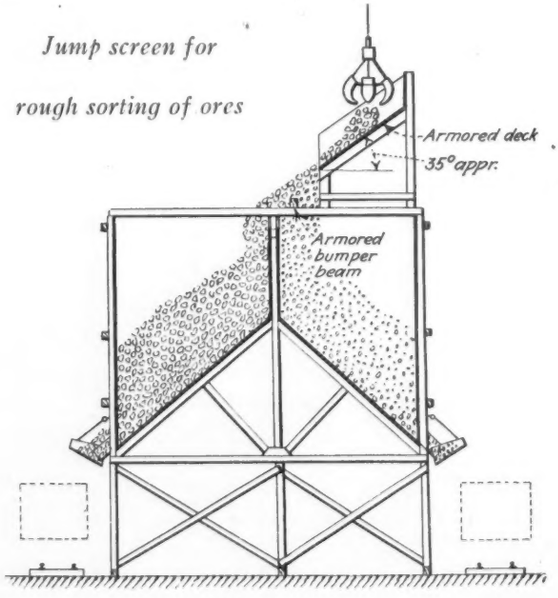
A Useful Jump Screen

By C. W. Tandy
Winnipeg, Manitoba

IDEA No. 2

ON THE Granby Consolidated docks at Anyox, B. C., is a screen that is unique in principle and simple in design. It has long been observed that when solid materials are dumped into a heap the larger pieces tend to settle near the base. This phenomenon may be explained thus: the larger pieces in falling have the greater momentum and are less easily retarded. Furthermore, in consequence of the greater momentum they attain a greater velocity than the smaller pieces in traveling the same slope distance. As a result of this difference in velocity, the trajectory of the larger pieces is longer, a fact which is turned to advantage in the design of the screen.

Jump screen for rough sorting of ores



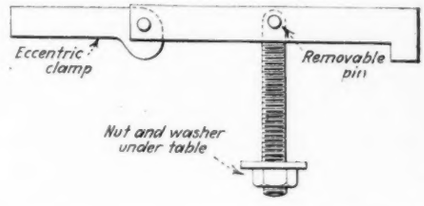
The screen works as follows: The ore is dumped on a moderately inclined plate, not too steep and yet not too flat, and is allowed to gravitate toward a bin divided into two compartments by a partition running at right angles to the direction of the flow. The finer ore drops into the first compartment and the coarser ore jumps into the second compartment. Sorting is roughly done, but is sufficiently close for the purposes intended. The location of the armored bumper beam influences both the size and the proportional amounts of the material delivered to the compartments. The material screened is Maple Bay silica rock, which is unloaded from a scow by an orange-peel grab bucket. Screen products are transported in gondola cars to the smelter for use in its blast furnaces and converters. Credit for devising the "jump screen" is to be given to Mr. J. B. Haffener, a former general superintendent.

Eccentric Drill Press Clamp

IDEA No. 3

THE CLAMP shown in the illustration can be used on most jobs that are handled on the drill press. The pin in the center is removable, so that the operator may put the bolt up through the table. The eccentric clamp on the end opposite the work is another time-saver, as well as being able to hold the job in place

A clamp for drill-press work



so that it will not move. This clamp can be applied and tightened without the use of a wrench. If work should be very high above the top of the table, adjust the clamp end correspondingly.

Electric Hoist Practice

IDEA No. 4

IN REGARD to electric hoists, an operator of experience states that it is important to keep the resistance units tightly bolted together and to erect the hoist far enough away from the shaft to hold down the "fleet angle" to below the 1.5 deg. demanded by good practice. As defined by Peele, the "fleet angle" is the angle in plane of drum and sheave shafts between center of sheave and extreme positions of rope at ends of drum face.

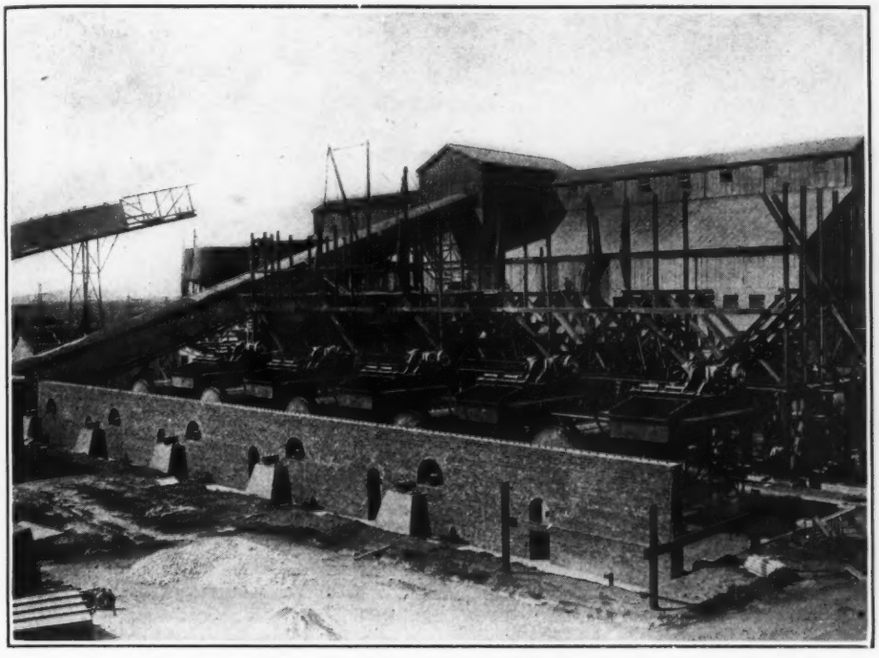
Many electric hoists, our correspondent maintains, are built with too much stress on compactness, with the resistance mounted on the frame. He prefers to remove this and erect it where the vibration will not induce breakage of the grids and loosening of connections.

A Better Casting Means Better Equipment

IDEA No. 5

UNDER suitable conditions the addition of a moderate percentage of nickel improves gray-iron castings by making them more homogeneous. The metal is stronger iron and of closer grain. The result has been an economy in foundry work; fewer imperfect castings are obtained and fewer rejections made in the machine shop. More important than this is the increased service rendered by mechanisms constructed with greater strength and of better metal. This is of particular importance in the mining industry, where mechanical equipment must respond to adverse conditions and where its failure may result in costly shutdowns.

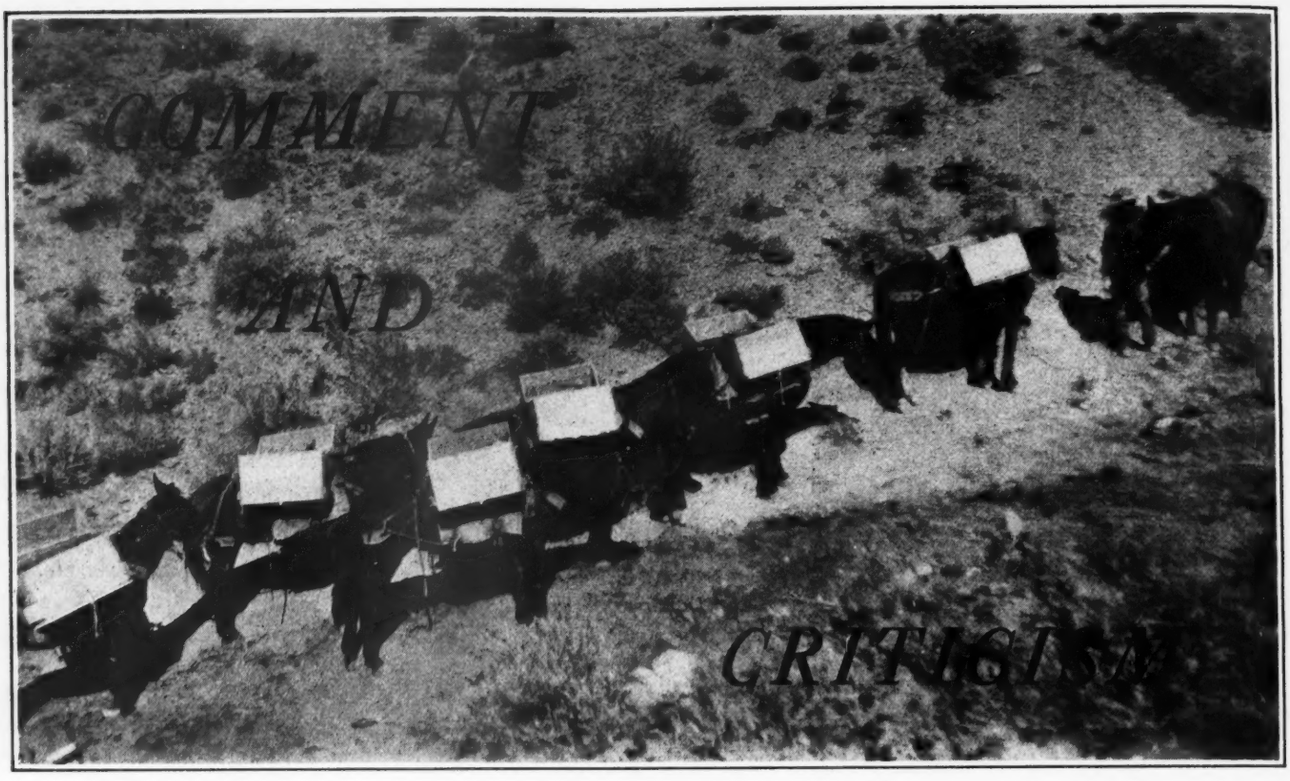
Progress in South Africa



Tube mills and Dorr classifiers are replacing stamps, as exemplified by the picture, at the left, of the new plant at the Government Gold Mining Areas. The change indicates that an appreciable saving in cost can thus be made.

Randfontein Estates, whose mill is shown below, boasts of the largest collection of stamps in the world—600—under one roof. But in the newer plants, capital cost and simplicity of operation, rather than size or number of units, is the criterion.

The illustrations shown above are published by courtesy of *Mining and Industrial Magazine* of Southern Africa



Misconceptions Are Not Confined to Geological Conclusions

THE EDITOR:

Sir—Allow me to voice regret that *Engineering and Mining Journal* should have published C. M. Campbell's article entitled "Misconceptions of Canada's Pre-Cambrian Shield."

American capital and American engineers working side by side with Canadian capital and engineers, receiving the same courtesies and consideration regardless of nationality, do not welcome a thrust at their united enthusiasm in the exploration and development of the splendid mineral resources of the area designated as the Pre-Cambrian Shield. *Engineering and Mining Journal* is a dignified publication, widely read by a fraternity whose interests are international, and should be above depreciating the unknown possibilities of a terrain that has made and is now making history in metal mining.

The natural resources of a country were never developed by pessimists; the vast mineral wealth of our own Western states was discovered and made tangible by the efforts of men of the same stamp and actuated by the same enthusiasm as those responsible for Canada occupying today the premier position as a mining field of great promise.

Canada is a vast country, with a population of only ten millions. Emerging from the war depleted in its most virulent man-power and heavily in debt, it has turned from a debtor to a creditor nation in less than ten years. Mining activities have had a considerable part in this remarkable accomplishment, as, besides the direct results, they have been stimulating to general business, adding to the confidence and optimism in Canada's economic future. In view of the recent development of nickel, copper, gold, lead, and zinc deposits of first magnitude, adding hundreds of millions to the known store of wealth in the ground, it is perfectly logical that this feeling should exist.

Canadians view, with good natured tolerance, the geological smoke bomb, cast from far off Namaqualand. Had it not been picked up, amplified, and broadcast by your well-regarded publication it would have expired properly in the files of its somewhat erudite but academic author. Americans enjoying equal privileges and the esteem of their Canadian contemporaries in the mining field do not view with the same equanimity their foremost vehicle of expression lending itself to a silly diatribe of this sort.

C. D. KAEDING

Toronto, Canada.

[Our esteemed correspondent is welcome to the hospitality of our columns to voice objection to Mr. Campbell's conclusions; but his rebuke to the effect that *Engineering and Mining Journal* "should be above depreciating the unknown possibilities of a terrain that has made and is making history in metal mining" is unwarranted.

To have refused publication of "Misconceptions of Canada's Pre-Cambrian Shield" merely because it was critical would have laid *Engineering and Mining Journal* open to severe and merited censure, but it is difficult to understand how anyone conversant with ordinary journalistic practice could assume, as Mr. Kaeding has done, that publication of a technical article implies editorial endorsement of the author's opinions and conclusions. We are frank in stating a belief that the deliberate suppression of criticism is hurtful to progress. Our columns are always open to those who are willing to criticize constructively, and so to render a service in the reaching of an agreement on a debatable point.

It is deeply to be regretted that Mr. Kaeding has sought to make an international issue of the publication of Mr. Campbell's article in *Engineering and Mining Journal,* by speaking of the attitude of Canadians toward it. Contrary to the impression conveyed by Mr. Kaeding's letter, Mr. Campbell is a Canadian who was born in Ontario and educated at McGill University. According to "Who's Who in Engineering," he held, between 1904 and 1924, the positions of engineer, superintendent, and resident manager with the Granby Consolidated Mining, Smelting & Power Company, in British Columbia. We see no reason why he should remain silent on any subject because he happens to be in Namaqualand. Our recollection is that he was fearless in presenting views personally at Montreal in 1926, at a meeting of the Canadian Institute of Mining and Metallurgy.—EDITOR.]

Penetration of the Earth by Meteors

THE EDITOR:

Sir—With regard to the action of the great Arizona meteorite at the moment of collision with the earth, your correspondent Mr. F. E. Stone, in the July 28 issue, presents a most interesting theory. In the literature on this subject I have noted that penetration of the strata is rarely mentioned as having taken place, and on this point this is in complete agreement with your correspondent's theory. I have examined many meteoric craters, and usually—I might say in all cases of hard strata—there are no signs of penetration, which further tends to confirm his point.

In the examination of very ancient craters, however, say of the age of the Arizona crater, I have never been able to observe any satisfactory evidence of what did occur when the meteorite collided with the earth. The action of weathering and other causes, operating over centuries of time, have attacked and disintegrated such meteoric craters so that the remaining evidence is indistinct. I have therefore selected for study only meteorites and craters made in recent times, some within living memory, and where climatic and other changes are progressing very slowly; in these, the evidence is much clearer.

Meteorites falling into lakes are probably quenched almost immediately, and are found in more or less cubical forms on the dried-up floor. Meteorites colliding with hard strata, such as the great Arizona meteorite encountered, depress a crater, but in the process are themselves flattened out to a distance very much beyond the crater. There, on rapidly cooling, they break up into fragments ready for rapid disintegration by weathering. Nearly always they are then oval in form, having about a ratio of six to five for their major and minor axes. The harder the strata the thinner is the meteorite, owing to pressure and flowage. Under these conditions I have never found any sign either of penetration or rebound.

Meteorites falling on to a soft stratum, such as sand or peat, do not make a crater as usually understood, but a cavity almost like a large well-drilled hole, though the penetration is small, those I have tested usually not exceeding 18 ft. in depth. The meteor becomes egg shaped under these conditions and is found more or less intact. The accompanying photograph shows at the left a crater of this kind, the meteor being estimated to weigh about 8,000 tons and to be some 30 ft. deep. It is said to have fallen about eighty years ago, but the crater looks older to me.

If anyone should be interested, either scientifically or commercially, in this and a similar meteorite I shall be glad to show him the craters or supply any information desired. My address is Casilla 755, Antofagasta, Chile. These seem to be the largest meteorites known that promise to be intact.

A CHILEAN SUBSCRIBER.

Antofagasta, Chile.

A small meteor crater may be seen in the foreground at the left

"Mystery" Assaying and Promotion

THE EDITOR:

Sir—On July 21 you printed a letter in regard to tin in southern Oregon, in which I said that the white-metal mystery is not settled yet. I inclose a copy of the *Pacific Coast Miner,* printed in Grants Pass, containing an open letter to Mr. Hoover dealing with this "mystery white metal."

As I mentioned, Grants Pass "miners" will find tin, but if hundreds of local prospectors can recover tin I cannot see why any help is needed from government agencies.

The latest method to "make" white metal is as follows: Grind the ore and mix it with calcium carbide. The gas from the calcium carbide, after the ore and carbide mixture is wetted with water, will smother the white metal, which would otherwise escape. By panning, the white-metal globules can be separated.

This is not a yarn. This method is actually used and the results are absolutely convincing to hundreds of prospectors in Grants Pass.

The unfortunate thing in this elegant test is that one will find the metallic globules in the calcium carbide alone, without using any ore at all. They are magnetic iron reduced from coke containing it as an impurity in the manufacture of calcium carbide in the electric furnace.

GEORGE SCHUMACHER.

Medford, Ore.

[The letter to Mr. Hoover, since relayed to his successor at the Department of Commerce, is a lengthy and pathetic document. It bears the subhead "A Communication Addressed and Written as Will Rogers Might Write if He Were in Our Boots."—EDITOR.]

Public Confidence in a Consultant Is What Counts

THE EDITOR:

Sir—Many prospectors and ambitious promoters of mining companies think that the only necessary preliminary to selling stock is to secure the report or a description by someone who will sign his name as a mining engineer or a geologist. But the public is becoming doubtful of reports over unknown and obscure names. It is not buying stock offered for sale by means of promotion literature and advertisement.

Barron Collier recently said that "The true value of any name depends upon the confidence it has created. Building that confidence in one's name is the principal purpose of every honest man in any business." The same authority says that "If an article has no merit, advertising it will not pay." Mr. Collier's axioms apply to mining as well as to other business.

Capitalists will invest any amount of money on the report and recommendation of one of many able engineers in this country, and small investors will follow to the limit of their ability. But those engineers have spent years in building up confidence in their names, and not by garnering a lot of free advertising by writing reports for publication in the prospectuses of stock selling promoters.

From the very nature of the engineer's profession he becomes the de facto agent of the buyer, even if he is not the actual agent of the buyer employed to investigate. If his report is favorable, he is asking the investor to part with his money, upon an implied if not actually stated assurance that the money will be returned with its increase. If this be not a fact, why should the promoter, to effect his purpose, need an engineer's report?

Although an engineer is supposed to get just as much for saying "no" as for saying "yes," it is an obvious fact that many young engineers and the mediocrities of the profession seem to say "no" much easier when they are employed by the buyer than when reporting for the seller.

Even a good property can be "sucker bait" if in the hands of promoters who use it as such and know nothing about real mining. In fact, a poor prospect isn't good "sucker bait" in any one's hands. Some engineers dodge the opportunity to make a report on a really meritorious property because they can't recommend the outfit handling it. Several managements and promoters will not stand up under investigation, nor will their properties. To recommend an investment, the engineer is compelled to recommend the management as well as the property, which cannot always be done. The engineer has to stand a lot of abuse in case he offers to buy the whole, or the control, when he is satisfied with a property and not with its management.

LETSON BALLIET.

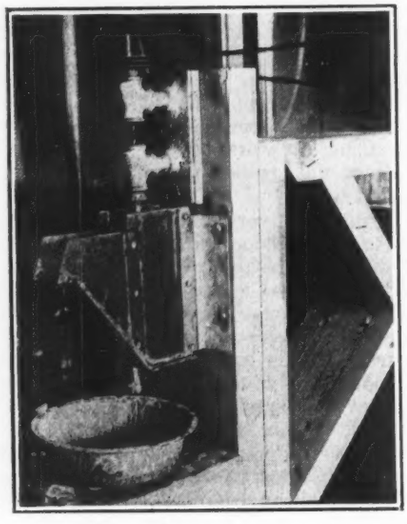
Tonopah, Nev.

INDUSTRIAL PROGRESS

New Laboratory Flotation Cell Developed at University of Utah

By H. D. KEISER
Assistant Editor

IN THE course of experimental work involved in the extensive study of flotation fundamentals that is being made at the University of Utah under the direction of Prof. A. M. Gaudin, it



The new cell mounted in the laboratories of the University of Utah

was found that the aluminum-painted galvanized-iron flotation cells of 50-gram capacity used at the laboratories had certain shortcomings. These features, although unimportant in rough work for which the cells were first designed, became objectionable in the refined work that is now in progress. The unsatisfactory character of the cells was due largely to the presence of iron and aluminum salts in solution in the cell. This effect was, of course, particularly noticeable when acid circuits were used. Metal parts of the cell also frequently reacted with reagents, and insoluble precipitates that were difficult to remove were formed on the surfaces of the cell. Materials used in the construction of the cells comprised iron, zinc, aluminum, oil (the base of the aluminum paint), cement (Dekhotinsky cement used in joining the glass panels of the cell), glass, and solder, and hence a greater risk of reaction between these substances and the reagents was involved than if the cell had been made of one material.

Cells of cast glass would have obviated the difficulties mentioned, but, besides being fragile, the intricacy of the necessary molds made the cost of such cells prohibitive. The only materials that appeared suitable, therefore, were noble metals, such as silver, gold, and platinum, and organic plastics of sufficient rigidity and resistance to solution.

A celluloid cell, as shown in the accompanying illustrations, was built, however, by C. C. Haynes, research fellow in the department of mining and metallurgical research, and the results obtained with it were so satisfactory that five more were made to replace the iron cells. Celluloid used in building the new cells is $\frac{1}{8}$ in. thick, transparent, easily machined, and pliable at the temperature of boiling water. The various parts of the cell are sawed out of stock sheet, grooves $\frac{1}{16}$ in. deep and $\frac{1}{8}$ in. wide are milled for joints, and $\frac{1}{8}$ in. holes for rivets are drilled where required. These parts are then fitted together, and glued with medium-weight collodion. To secure the proper relation of spitzkasten area to volume of the cell, the width of the spitzkasten is made $\frac{1}{4}$ in. less than that of the agitation chamber. Aluminum rivets plated with collodion are used in joining the side walls of the two chambers. The impeller shaft used in the cell is made of collodion-plated steel, or of glass.

These celluloid cells have been in use more than a month at the laboratories of the University of Utah, and have the following advantages over the sheet-iron cells that were formerly employed:

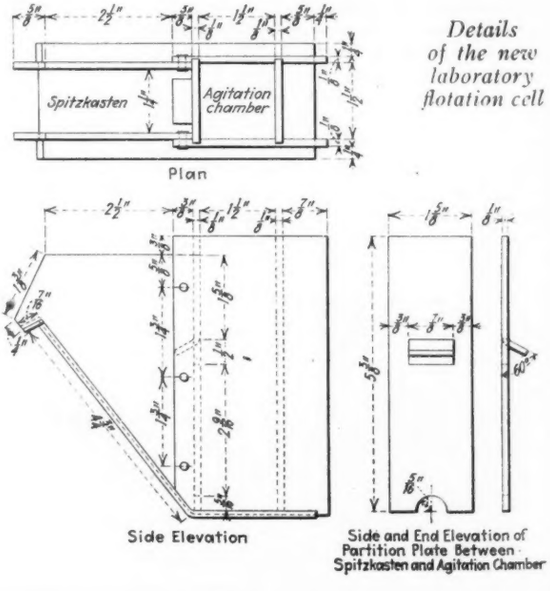
1. Greater visibility of operations within the cell is afforded by the transparent walls of celluloid.

2. One substance only is in contact with the pulp.

3. There is less danger of reaction between cell materials and reagents.

4. They can be made with less effort, and to more exact dimensions.

5. They are more readily cleaned.



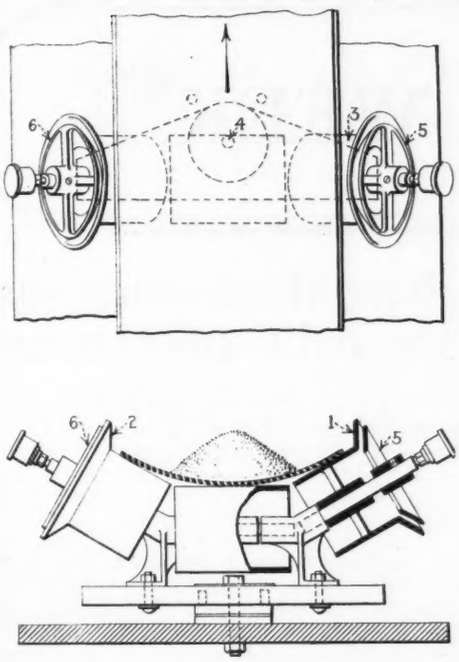
Details of the new laboratory flotation cell

Self-Aligning Idler for Belt Conveyors

AS a result of unequal loading and other causes, conveyor belts have a tendency to deviate laterally on the idlers supporting the belt, writes Edward Cuddihy, master mechanic at the Tooele Smelter in Utah. To prevent such movement, vertical guide pulleys placed at the edges of the belt have customarily been used. These do not remove the tendency toward lateral movement, but merely act as stops preventing it, and, as a result of the pressure of the belt against them, the belt is rapidly worn out at the edges.

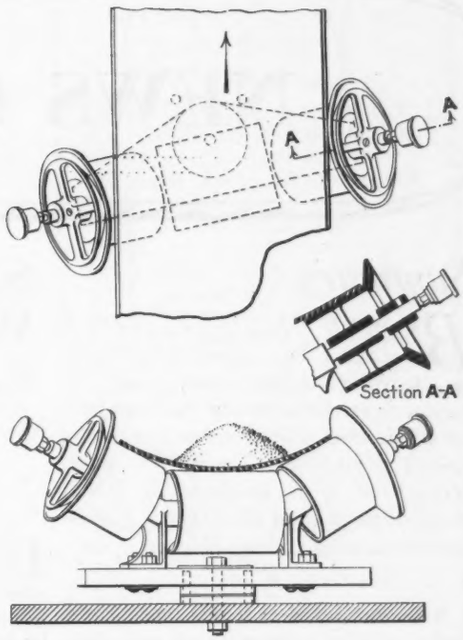
A troughing idler unit devised to oppose automatically any lateral deviation of the belt, and so pivoted upon a supporting structure that the lateral thrust developed by a shifting of the belt will turn the unit in a position to correct the deviation, is shown herewith.

As shown on the next page, the idler unit for a belt of given width is so designed that the edges of the belt normally clear the side flanges of both inclined idlers, that is, slight deviations of the belt may occur without bringing the belt into contact with the conical portions 1 and 2. Any substantial deviation of the belt, however, will bring the belt into engagement with one of the flanges,



Left, Plan and vertical views, respectively, of belt idler in normal position.

Right, Plan and vertical views, respectively, of belt idler in position to correct lateral deviation of conveyor belt. Also, vertical section along line A-A in upper drawing.



and the idler unit will then function to correct the deviation.

Assuming that the deviation is toward the right, the belt engages flange 1 of pulley 3, and this side pressure causes a turning movement about pivot 4, as it is not balanced by any pressure exerted on the opposite pulley. The idler unit will then turn counter-clockwise into the position shown in the right-hand views above, presenting the axis of the pulleys at an angle to the direction of travel of the belt. The forward movement of the belt will then carry the belt towards the left and correct the deviation.

Except in cases involving a rapid lateral deviation of some magnitude, the brake rings 5 and 6 take no part in the self-aligning operation of the idler unit, as the side pressure on the conical flanges will be sufficient to shift the unit under normal operating conditions. If, however, the lateral deviation is quite rapid and of considerable magnitude, the inclined idler will move upward along its stub to engage the conical flange 1 or 2 with the corresponding brake ring 5 or 6. The friction resistance will then exert a drag on the belt, and the reaction on the pulley will tend to drag the pulley ahead, thus pivoting the unit about the axis 4, and accentuating the angular discrepancy between the axis of the pulleys and the direction of travel of the belt. The turning movement is in the same direction as that exerted by the side pressure of the belt, and its effect is to hasten the return of the belt to its correct path.

As a result of the use of these self-aligning idlers on the belt conveyors at the Tooele plant of the International Smelting Company, the life of the belts has been considerably increased, and vertical guide pulleys have been dispensed with at the edges of the belts. An application has been made for a patent.

INDUSTRIAL NOTES

Eastern Electrolytic Zinc to Maintain Offices in New York, St. Louis, and Joplin

Eastern Electrolytic Zinc, Inc., a Delaware corporation, the holding company of certain rights for the use of the Tainton electrolytic zinc process, will maintain offices in New York, St. Louis, and Joplin at the following addresses:
68 Trinity Place, New York, N. Y.
William McClellan, vice-president, director;
709 Skinker Road, St. Louis, Mo.,
Foster S. Naething, director;
Cosgrove Building, Joplin, Mo.,
Victor Rakowsky, president, director.

William McClellan, electrical engineer, past president of the American Institute of Electrical Engineers and engineer appointee of President Coolidge on the Muscle Shoals project, will look after the power and electrical development of the company. Foster S. Naething, consulting mining and metallurgical engineer, will be in direct contact with plant construction and metallurgical development. Mr. Naething, for Eastern Electrolytic Zinc, Inc., developed and completed the plans and specifications for the construction of the East St. Louis unit of the Evans-Wallower Lead Company, and, in a consulting capacity, will be in contact with the construction of this unit. U. C. Tainton, metallurgist and patentee of the Tainton process, is also a director of Eastern Electrolytic Zinc, Inc. Mr. Rakowsky, who is a consulting mining engineer having mine- and ore-development interests in the Oklahoma-Kansas-Missouri zinc fields and elsewhere, will carry on the business of the company at the main offices, Cosgrove Building, Joplin, Mo. Eastern Electrolytic Zinc, Inc., recently made announcement of certain contractual arrangements with the Evans-Wallower Lead Company, one of the oldest and foremost zinc- and lead-ore producing companies in the Oklahoma-Kansas-Missouri zinc-lead fields, under which the lead company is constructing an electrolytic zinc plant, in which the Tainton process will be used.

H. H. SHERMAN has been appointed manager of the publicity department of the Chicago Pneumatic Tool Company, with headquarters at the company's general offices at 6 East 44th St., New York. He joined the company in 1927 as assistant publicity manager, having previously had many years' experience in industrial advertising and advertising agency work.

THE AMERICAN WELDING SOCIETY will hold its fall meeting in Philadelphia on Oct. 8 to 12 inclusive, at the Bellevue Stratford Hotel. Papers discussing the various phases and applications of welding will be presented.

PATENTS

HOIST BRAKES—Ottumwa Iron Works, Ottumwa, Iowa. Bulletin No. 275, entitled "Ottumwa Proportional Pressure Oil Braking System." Sixteen pages.

SUPERHEATERS—Foster Wheeler Corporation, 165 Broadway, New York. Bulletin 304. Foster superheaters. Forty-eight pages.

ROLLER BEARINGS—Timken Roller Bearing Company, Canton, Ohio. A 44-page bulletin entitled "Why Timken Tapered Roller Bearings Save Money for Mine Operators."

SYNCHRONOUS MOTORS—General Electric Company, Schenectady, N. Y. Bulletin GEA-1052. The G-E general-purpose synchronous motors, 7,500 series, form EL. Four pages.

NEWS OF THE WEEK

Summary

BROKEN HILL Associated Smelters has acquired interests in Australian copper mining and refining, in addition to its lead and silver affiliations. This company recently bought Hampden Cloncurry Copper Mines and large holdings in Metal Manufacturers and Electrolytic Refining & Smelting. Page 511.

* * *

It is considered probable that President Coolidge's program of economy may affect the appropriation for the U. S. Bureau of Mines. Director Turner of the Bureau has just returned from an extensive trip through the Southwest. Page 507.

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Flotation, as advocated by the Bureau of Mines, will be used by four or five of the large mills in the Michigan copper district. Higher prices for copper and increased efficiency stimulate activity. Page 510.

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Howey Gold, in the Red Lake district of Ontario, will build a mill to handle its low-grade gold ores if the Canadian government makes a start next year on the development of power at the Ear Falls Dam. Page 511.

* * *

Mexico's first safety meet, held recently in Mexico City, proved a success and will probably be repeated next year. Teams from many of the important mining districts competed. Page 509.

* * *

Gold Hill & Iowa, Idaho's largest gold producer in the past, has struck new ore, according to Stewart Campbell, State Mine Inspector, and should be producing steadily by the first of next year. Page 508.

* * *

New process of platinum extraction devised by Central Mining & Investment may result in recovery of 70 per cent of the platinoid content of the original ore. Page 511.

Southern Rhodesia Base Metals Suspends Work at Copper King and Copper Queen

Transportation Difficulties and Low Prices for Lead and Zinc Result in Ceasing of Development at Mines—May Be Reopened If Railroad Is Built or Metal Prices Go Up

By George L. Walker
Special London Correspondent

DEVELOPMENT work at the Copper Queen and Copper King properties, in the Lomagundi district of Southern Rhodesia, has been suspended by Southern Rhodesia Base Metals. All equipment, including the pilot mill, will be transferred to the company's Alaska mine for construction of a 250-ton reduction plant there. Possession of the Copper King and Copper Queen will be retained, and, if a railroad is built or if the prices of lead and zinc advance, development will probably be resumed. During the last two years, nearly $1,000,000 has been spent on development work.

Prospectors employed by the company discovered the Copper Queen about three years ago. A complete story of the discovery and geology of both properties appeared in *E. & M. J.* of March 26, 1927.

Though it seems likely that the property has important possibilities in the areas farther away from the intrusive where the ore formation has been proved to continue at depth, and where it probably is less crumpled, the management is indisposed to spend any more money on it at present. The grade of the ore developed—Copper Queen, 474,000 tons, averaging 2.3 per cent Cu, 2.2 per cent Pb, and 4.7 per cent Zn; Copper King, 335,000 tons, 3 per cent Cu, 1.5 per cent Pb, and 5 per cent Zn—is not considered to be high enough to warrant railway extension and expenditure for plant under the conditions now prevailing. As the ore also carries about $1.50 per ton of gold and silver, however, giving it a total value of about $16 per ton, it is believed that with the further opening up of the country renewed attention will be justified.

The Minister of Mines of Southern Rhodesia has expressed appreciation of the energy and efficiency with which the work of development was conducted. He intends having the engineers and geologists of his department examine the properties and report on the advisability of further prospecting and development.

About 1,000,000 tons of oxide ore averaging 3 per cent copper is developed at the company's Alaska mine, and the sulphides below, so far as opened, seem to be of still better grade. This property, only 12 miles from the railhead at Sinoia, is to be developed further, and production to be started in a small way as soon as possible. The company has over $250,000 in the treasury, and also equipment that cost nearly double that sum.

Silver Basin Finds New Ore at Jackson Mine

SILVER BASIN MINES, operating the Jackson mine, in the Slocan district of British Columbia, has found new ore showings to the east of the old workings, according to W. G. Smith, superintendent of operations. The ore, which carries silver, lead, and zinc, and is of milling grade, was discovered by deep trenching through heavy overburden. It averages 12 ft. wide. In its earlier days, the mine was worked at a point about 700 ft. west of the new discovery, and it is believed that the latter may prove to be an extension of the old orebodies. A new crosscut has been started on the hillside, which, it is thought, will intersect the discovery within 200 ft. It is also proposed to drive another crosscut about 120 ft. higher up.

The company has recently completed construction of several buildings, including cook and bunk houses with accommodations for 40 or 50 men. Transportation to the mine is facilitated by the Kaslo-Slocan highway. R. H. Stewart is managing director and consulting engineer of the company.

Tri-State Mill Burns

On Sept. 18, a fire destroyed the Patty C. mill, near Webb City, Mo., in the Tri-State district, with a loss of about $75,000. The fire was caused by a hotbox in the engine room of the mill and spread beyond control before the fire department of Picher, Okla., could reach the scene. The mill was of 300 tons' capacity.

Coolidge Economy Policy May Affect Budget of U. S. Bureau of Mines

Director Turner, of the Bureau, Returns to Washington From an Extensive Trip Through the Mining Districts in Southwestern States

By Paul Wooton
Special Washington Correspondent

IT IS apparent that the next fiscal year will be a lean one for the federal departments, inasmuch as the President apparently plans to carry his policy of rigorous economy in governmental expenses through to the end of his administration. In fact, it is not unlikely that this policy will be emphasized in the budget which he will submit to Congress in December. Mining men are wondering if this will not result in curtailment rather than expansion of the funds for research work of importance to the industry. Curtailment will mean a setback of at least a year in the program which the industry has been supporting in an effort to secure more equitable treatment.

The change in the executive head of the Department of Commerce came at a time that will affect the amounts of the appropriations for that department. The new Secretary naturally is not in a position at this time, when the budget is being made up, to set up his judgment against that of the Director of the Budget. Secretary Whiting, however, has lost no time in familiarizing himself with the work being done by his department for the mining industry. Last week he spent an entire afternoon at the Bureau of Mines, looking over the entire establishment and discussing the work with Director Turner and with the head of each division. Secretary Whiting expresses a determination to keep in close touch with each of the eleven bureaus in his department, in the hope that he may be able to assist them in extending greater service to those portions of the public which they serve.

Director Turner, of the Bureau of Mines, has returned from an extended visit to the Bureau's field stations and offices. He inspected the new helium plant at Amarilla, Tex., which eventually will take the place of the Fort Worth plant for the production of helium for the army and the navy. He reports that the work of drilling the Bush B-1 well, which was started July 14, is progressing favorably. On Sept. 22, the 8½-inch casing was landed and cemented at 2,940 ft. This is 40 ft. below the top of the great limestone bed. The top of the gas sand will be encountered, it is believed, at a depth of from 3,300 to 3,500 ft. The first test well put down by the Bureau, in May, was drilled to a depth of 3,657 ft., in which the limestone was encountered at 3,030 ft. Production from that well is 7,100,000 cu.ft. a day. It is backed by a rock pressure of 725 lb. to the square inch.

All of the potash locations were visited by Director Turner, including the site of the No. 9 well in Regan County, Tex., which was completed Sept. 6 at a depth of 1,700 ft. Of that distance 1,104 ft. was churn drilled to a point near the top of the salt, which was found at 1,110 ft. The remaining depth was obtained with a diamond drill, and 100 per cent of the core was recovered. The potash content has not been determined as yet.

On his way westward Mr. Turner visited the various mining districts of New Mexico. He viewed the meteor crater near Winslow, Ariz., where an effort is being made to recover the meteoric iron. Various portions of Arizona and Utah were visited, including the area south of Thompsons, Utah, where the Bureau is planning to undertake some potash investigations. He looked over the oil shale plant at Ruleson, Colo., and the Bureau's offices in Denver.

Returning eastward, Director Turner visited the Bartlesville, Okla., petroleum and gas experiment station, which is the largest government establishment of its kind in the world, and inspected the clinic at Picher, Okla., which is maintained by the Bureau in co-operation with the Metropolitan Life Insurance Company and the Tri-State Zinc & Lead Ore Producers' Association. This clinic is furnishing the most accurate cross-section of industrial health ever secured. Complete physical examinations of more than 10,000 miners and members of their families have been made.

The station at Rolla, Mo., and the first-aid and mine rescue stations at Vincennes and Evansville also were visited, as was the Bureau's office at Duluth. Mr. Turner visited some of the large quarries in the Great Lakes region and ended his trip with a thorough inspection of the Pittsburgh station, the principal laboratory of the Bureau, which houses more personnel than the Washington office.

American Interests Acquire La Concepcion y Anexas

La Concepcion y Anexas, situated near Las Pailas, State of Guerrero, Mexico, has recently been acquired by American interests, which intend to work the property on a large scale. The mines are principally quicksilver properties, carrying a pyritic sulphide that contains cinnabar and averaging 3 per cent quicksilver. Machinery for the new operations is now being purchased and work will be actively started during October under J. D. Burke, superintendent.

Treadwell Yukon Uses Bonus System at Errington

RAPID drifting is being accomplished in the development program at the Errington mine of Treadwell Yukon, in the Sudbury district of northern Ontario, as a result of the bonus system employed in paying the miners. From 105 to 115 ft. of advance is made per six-day week. In the larger headings (9 x 9 ft.) two drills mounted on a bar are used, the crew consisting of two machine men (no helper) and three shovelers. No timbering is needed. In the smaller headings, the crew is composed of one machine man, a helper, and three shovelers. In either heading, the crew is paid $10 per foot of advance. Out of this the men pay for powder and fuse and then divide the balance equally after allowing each "day's wages."

The underground daily wage scale is as follows: Shovelers, 53c. per hour (eight-hour day); miners, 60c. per hour; shift bosses, 87½c. per hour.

Third Empire Mining Congress to Be Held in South Africa

THE Third (Triennial) Empire Mining and Metallurgical Congress will be held in South Africa in 1930. F. W. Beyers, Minister of Mines and Industries for the Union, extended the invitation to the congress, and it has been accepted by the Empire Council of Mining and Metallurgical Institutions, on behalf of the ten constituent bodies. The congress will meet in Cape Town on Monday, March 24, 1930, and sessions will probably be held in Cape Town, Kimberley, Johannesburg, Bulawayo, and Durban.

A tentative itinerary has been arranged, which comprises visits to all the principal mining centers in the Union and Rhodesia, as well as to places of scenic interest. Those attending the congress will have the opportunity of visiting the diamond mines at Kimberley, the gold mines and works of the Witwatersrand, the gold, diamond, platinum, coal, asbestos, and copper mining districts in the Transvaal, and the Sabie game reserve. The Rhodesian tour will include Victoria Falls, one of the greatest natural sights in the world; gold, copper, zinc-lead, asbestos, and coal mines; and the Zimbabwe ruins. Members will also be enabled to visit the coal fields of Natal as well as some of the beauty spots of that province and the port of Durban, returning to Cape Town by a circuitous route which will take in Bloemfontein, Port Elizabeth, Oudtshoorn, and the Knysna Forest.

Gold Hill Mine, in Idaho, Finds Ore on 700 Level

A FIFTY-FOOT crosscut on the 700 level of the Gold Hill & Iowa mine, at Quartzburg, Idaho, recently struck a continuation of the ore formerly mined on the 600 level. The width and length of ore are as yet unknown, according to Stewart Campbell, State Mine Inspector of Idaho, who recently visited the property, now owned by Talache Mines, but it has been opened for a distance of 45 ft., the first 25 ft. averaging more than $35 a ton in gold.

Talache Mines, which also controls a silver mine in Bonner County, acquired the Gold Hill mine in March, 1927, and immediately started unwatering operations, which were concluded on Nov. 15, 1927. A winze was sunk from the 600 to the 700 level, and the crosscut which struck the ore was started. At present 41 men are employed at the property and more than $10,000 worth of ore is piled on the dumps. The mill and surface plants are being rebuilt and re-equipped, and A. H. Burroughs, Jr., president of Talache Mines, expects that the mine will be producing by Jan. 1, 1929.

The Gold Hill mine was discovered in 1863, and has been operated since then almost continuously. Its production record is approximately $8,000,000. After suspension of operations in December, 1922, because of financial difficulties of Gold Hill & Iowa Mines, the company that owned it at the time, the mine was taken over by lessees. When attempts to sell the mine proved futile, it was allowed to fill with water early in 1926, after all developed ore between the 500 and 600 levels had been extracted.

Panuco District in Sinaloa Shows Marked Activity

Reports from the Panuco district, State of Sinaloa, Mexico, are to the effect that operations at the El Muerto and El Duente properties will be considerably increased and that work will be resumed at the Palos Verdes and Sol mines, which have been idle for some time. The condition of the roads leading into the district has been improved, thus stimulating activity. The proximity of the new smelter at Mazatlan is also a favorable influence. Several new claims have been acquired recently for exploration purposes. Most of the financing of properties in the district is being undertaken by Americans.

Big Bug Mine Is Leased

Double O Metals has acquired a five-year lease on the Arizona National mine, in the Big Bug district, near Humboldt, Ariz. The property is developed by two shafts, the deepest one being bottomed at 520 ft. It was closed down more than two years ago, but the new operators have started a 60-ton flotation plant, treating the lead-silver ore. A description of the Big Bug district by Lloyd T. Emory was published in *E.&M.J.* of March 17 last.

Japanese Government Bans Underground Work for Women and Minors

CONSPICUOUS improvement in labor conditions has been a characteristic trend in most of the Western countries. Permeation elsewhere of the fundamental idea has occurred, but progress has been slow in the Orient. Japan only recently promulgated legislation forbidding the employment of women and children in mines, and regulating the daily hours of labor of all mine workers to ten. Heretofore women have toiled underground as muckers and trammers at a wage of from thirty to forty cents gold per day. However, the reform outlined will not go into full effect for three years.

Late work at night for women and minors is also forbidden, the proscribed time being between 10 p.m. and 5 a.m., except under two shifts, but work may continue to 11 p.m. by special permission. Night work above ground, such as grading and sorting, may continue to midnight with two shifts and with special permission, but in such event work will not be resumed until 6 a.m. Employers have the right to petition for special privileges when work arises that demands immediate attention.

India also forbids the employment of women in mines, but the legislation to that effect is to be enforced over a ten-year period. Conditions in Oriental countries are such that reforms affecting labor must be made gradually.

Will Increase Capacity of Jack Waite Mill

ADDITIONAL equipment, which will increase the capacity of the Jack Waite Consolidated mill, in the Coeur d'Alene district of Idaho, to about 400 tons daily, has been ordered by M. L. Savage, manager of the mine. The Jack Waite mill was only recently put into operation after being remodeled and re-equipped so as to treat the silver-lead ore from the mine by flotation methods. Included in the new equipment ordered are an 8-ft. Hardinge ball mill, with Falk gear drive, a ten-cell Minerals Separation flotation machine, and a 6x8-ft. Oliver filter, complete with vacuum pump. An electric hoist, which can lift a two-ton load from a depth of 1,000 ft., will be installed.

Motor trucks are being used to transport the concentrates from the mill to the railroad, 3½ miles distant. This is considered more economical than extension of the railroad to the mine. Weekly shipments of concentrates to the Bunker Hill smelter are averaging about seven carloads, assaying 65 per cent lead and 8 oz. of silver to the ton.

Small Mexican Mine Owners Ask for Changes in Laws

A commission, representing owners of small mines, is now in Mexico City to ask for changes in the laws relating to prospecting and mine ownership, which, it is claimed, are unfavorable to the independent mine operator with limited capital. The commission also has the sympathy of many large operators in asserting that the provisions requiring definite expenditures and production are unjust. A petition will be presented to the mining division of the Mexican Department of Commerce, Labor and Industry.

Union Sulphur Completes Foundation for Steam Plant

UNION SULPHUR has completed the foundations for its steam plant at Boling, Tex. When completed, the plant will consist of 24 boilers, with a total capacity of 5,000 hp. According to John Richardson, plant superintendent of the company, the new plant will have an initial production capacity of 1,500 tons of sulphur a day.

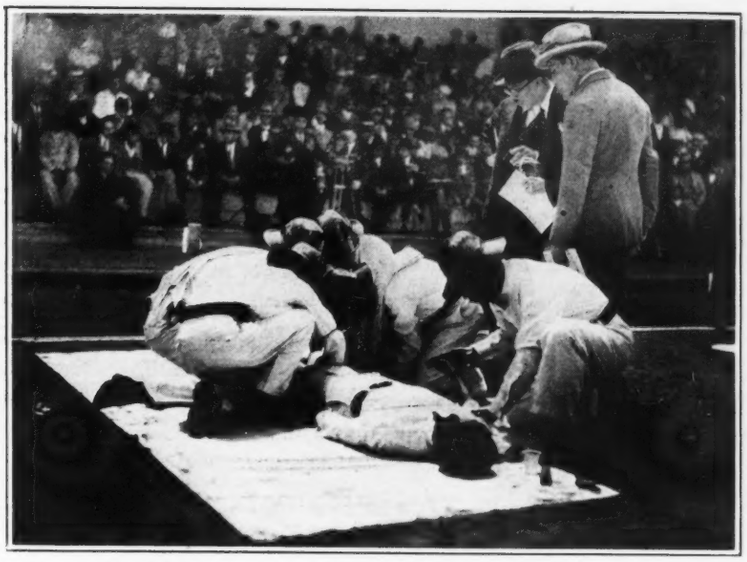
The company has made a contract with Houston Gulf Gas for its fuel supply, and a pipe line is being laid.

Bradley Interests Exploring Boulder Canyon Dam Region

It is reported that the Bradley interests, of San Francisco, are planning a survey of the area tributary to the proposed Boulder Canyon Dam. A. W. Udell, of the Bradley engineering staff, is in the district with a force of assistants, making the most complete examination of mineral resources ever attempted in that area. This survey is for the purpose of ascertaining the extent to which the mineral wealth may be utilized in establishing industries fundamental to Nevada. In this undertaking the Bradleys may become associated with other combinations of capital having headquarters near Las Vegas.

Durango Company Installs Additional Power Unit

Latin-American Milling, which is preparing to work a number of old properties in the Vicente Guerrero district of Durango, Mexico, including a 300,000-ton tailings dump, is completing the installation of an additional Diesel engine, to supplement the one already in use. Mill capacity is being increased.



Hard-boiled hats become fashionable in Mexico above as well as underground

Mexico Holds Its First Safety Meet

Teams From Many of the Important Districts in the Country Were Represented at Field Demonstration

IN THE stadium of the Corregidora School, City of Mexico, the first safety meet ever held in Mexico was recently conducted under the auspices of the mining division of the Department of Commerce, Labor and Industry. The meet consisted of first-aid and mine rescue demonstrations, similar to those recently given in Butte, Mont., at the international meet held there. Teams from many of the important mining camps in the republic competed in the various contests. There were representatives from Fresnillo, Sierra Mojada, Santa Gertrudis, Real del Monte, El Oro, San Rafael, and Rositas.

B. F. McDonald, an experienced engineer in first-aid work and formerly connected with the U. S. Bureau of Mines, acted as consulting judge, with the following Mexican engineers as assistants: Enrique Ortiz Genaro Montes de Oca, Adan Nobile, Pedro Moyo, Ignacio Gonzales, and Jorge Mackintosh.

The remarkable efficiency of the various teams was a revelation to many spectators. The Mexican government and the large mine operators have been taking an active interest in the work of installing safety appliances in the mines and in teaching the men the rudiments of safety work. So successful was the meeting that it is proposed to hold a similar demonstration next year, possibly during the convention in Mexico City of the American Association of Engineers, which will be attended by representatives from all parts of North and South America.

An exhibit of the latest safety appliances for mine work was held in conjunction with the gathering.

Colorado Mines Improve Equipment and Transportation

J. J. BONNER, who is in charge of the work at the Blair mine, on Leavenworth Mountain, Georgetown, Colo., which was closed for 25 years, reports a streak of ore in the breast of the adit.

Virginia Mining, which took over the Combination mill, on Clear Creek, in Idaho Springs, made arrangements to install flotation machinery and for a general overhauling of the mill, and will soon be prepared to handle its own ore and much custom ore in that section.

Edward Butts, manager of the Saxon Exploitation Company, operating the East Griffith group of claims, on Saxon Mountain, has let a contract for the building of a new and better road leading between the mine and the main road.

The new mill of North Amethyst Mining, in the Creede section, is reported to be ready for work. It has a capacity of 50 tons of ore each 24 hours, but when the mill and the mines are to be operated jointly the mill will work only about 30 tons, as the power plant is inadequate to cope with the double load. J. I. Brown flotation machines were installed at the mill, Mr. Brown personally supervising the installation. The operating company is known as the Equity.

O. Barlow Wilmarth, manager of the Prize mine, operating through the Argo tunnel, at Idaho Springs, reports some ore uncovered at its 850 level. The mill is being worked by hand, but power is to be brought in, and many improvements will then be made.

The surface strike made by Hartman and Clifford on ground of the New El Paso Mines, Inc., on Beacon Hill, Cripple Creek, continues to widen as progress is made. Six carloads of ore has been shipped to the mill of the Golden Cycle, at Colorado Springs. It brought from $26 to $30 a ton.

Texas Gulf Constructs Model Town Near Its Mines

ONE of the most striking examples of new town building ever witnessed in Texas is that of the Texas Gulf Sulphur Company, the location of the project being at the large sulphur deposit which the company is preparing to develop on an extensive scale near Wharton. The townsite of Newgulf is laid out on the most modern lines. When the company recently began the construction of its sulphur-mining plant it also awarded the contract for the erection of 114 residences for its employees. All but about 30 of these homes have been finished. A contract has just been let for the construction of 96 additional residences, making a total of 210, all of which will be completed by the time the mining plant is ready for operation.

In the business center of the new town attractive buildings for various kinds of commercial activities have been erected. The company has provided the community with a complete water-supply system, and natural gas mains have been laid all through the residential and business districts. Parks and places of amusement are being provided, and Newgulf will soon be a completed, well-ordered, modern community.

Kennedy Starts to Repair Fire Damage

REPLACEMENT of the surface plant destroyed by the fire on Sept. 7 at the property of Kennedy Mining, near Jackson, Calif., will cost about $150,000, it is estimated. Steps have been taken to secure an emergency hoist and compressor to serve the main or east shaft. In the meantime, the mill has continued operating.

E. C. Hutchinson, managing director of the company, states that the east shaft has been examined to the 2,400 level and found to be in good condition. An examination from the 3,900 level to the bottom of the mine also showed this part of the shaft to be without damage. The north shaft will be used until the east shaft resumes to take care of the flow of water to the 2,300 level. Drainage from the 2,300 to the 3,750 will be handled in co-operation with Argonaut Mining, which rendered assistance during the fire and which generously offered its facilities to Kennedy Mining. It is expected that in this way about 55,000 g.p.d. can be handled out of a possible 75,000 g.p.d.

Strike Reported at Magma

Reports from Magma Copper, at Superior, Ariz., state that the company has cut a new oreshoot, containing copper, silver, and gold, on the west side of the No. 5 shaft at the 2,550 level. The vein, where cut, is said to be 10 ft. wide and to average 11 per cent copper, 3.22 oz. silver, and .03 oz. gold. The new ore has been drifted on for 45 ft. from the point where it was first struck.

Michigan Copper Companies Plan to Expand Use of Flotation Methods

Magnetic and Electrical Prospecting, and Power Development Also Mark Activity of Producers

WITH costs as low as in 1927 and with 1½c. more per pound for copper, Mohawk, with a slightly lower production, will do better this year than in 1927, which was the banner year for the property. A Fahrenwald flotation machine will be installed about Nov. 1. It will save, it is estimated, approximately 2½ lb. per ton of copper now wasted in the tailing.

The stamp mills in the Michigan district which will be equipped with Fahrenwald flotation machines for treatment of amygdaloid mineral are the Champion mill of Copper Range, Mohawk, Ahmeek, Isle Royale, and probably the Lake No. 2 mill, owned by Calumet & Hecla Consolidated.

In the Champion Copper Company's exploratory tract between the old Atlantic and Globe mines, drilling is proceeding at a point two miles southwest of the old Atlantic workings. Magnetic dip-needle work continues, and the Radiore Company, of Los Angeles, is testing its method of electrical prospecting. In the Radiore work to date, the indications are described as weak but consistent.

Engineers of Stone & Webster, Incorporated, have been making a survey for Calumet & Hecla Consolidated with a view of increasing the company's power supply. The company's main power plant is at Lake Linden.

Indications of a highly mineralized area in virgin ground west of the old Tamarack Junior are seen in the excellent showing in the conglomerate lode in the 64th level of Calumet & Hecla's slope shaft, which is sunk from the 57th level of the Red Jacket shaft to mine the bed in the so-called "Five Forties."

At the Carp Lake property, in Ontonagon County, the tunnel has reached a length of over 500 ft. It has passed through a wide amygdaloid vein containing some copper and now is in a barren amygdaloid formation. The tunnel is about 300 ft. from its main objective.

At Calumet & Hecla Consolidated's Keweenaw County exploration in the Michigan copper district, a break in the hoist at the Phoenix shaft will delay the starting of exploratory work at Phoenix about a month. The accident to the hoist prevented reaching the pumps, and as a result the lower part of the mine is again filling with water. A contract for diamond drilling at both Cliff and Phoenix has been awarded and one drill has been started in the bottom of the Cliff shaft, which has been unwatered for some time.

At Arcadian Consolidated, the south drift in the New Arcadian vein at the 1,700-ft. level of the New Baltic shaft continues in good stamp rock.

Railroad Reaches Flin Flon Mine, in Manitoba

HUDSON BAY MINING & SMELTING has made the following progress at its Flin Flon property in Manitoba, Canada: Steel has been laid to Mile 85, thus virtually completing this important part of the project. The railroad will not be completed for some time in respect to ballasting and other details, but completion of steel means that a certain amount of construction material can be hauled over the road and delivered to its terminus. Several sink holes have been encountered on the railroad line, and as a consequence thousands of yards of fill have been necessary at these places; otherwise the road would have been completed earlier in September.

The pilot plant at the mine is in operation, and interesting results have been obtained. The difficulty caused by the use of muskeg water in mill operation has been overcome. MacIntosh flotation machines are being installed for comparative testing against Minerals Separation machines. Tests on cyanide regeneration have been made. Preliminary preparations for the erection of the power plant and the installation of equipment are under way, and arrangements are also being made to haul about 15.000 tons of freight from the railroad, 70 miles by road, to the power plant.

The designs for the plant have been prepared at Winnipeg under the direction of Jules Labarthe.

Tyrone Leaching Plant to Be Transferred to Douglas

PHELPS DODGE has announced that the leaching plant formerly operated at Tyrone, N. M., for its Burro Mountain branch will be transferred to Douglas, Ariz. The transfer, it is said, will involve only a small amount of new construction, as use will be made of the present buildings at the Copper Queen smelter. The plant will occupy the building in the smelter yard formerly used by the Dwight P. Robinson Construction Company. Equipment in operation in Tyrone last year is being dismantled and shipped to Douglas.

Test plant equipment includes a fully equipped chemical laboratory for ore and solution analyses; receiving bins for coarse ore storage, crushers, and screens; leaching tanks; solution storage tanks; electrolytic cell equipment; and miscellaneous mechanical equiment. By moving the plant to Douglas, leaching tests on various low-grade ores from the company's properties will be facilitated. B. H. Cody will have operating charge of the work, under the direction of C. Legrand, consulting mechanical engineer.

New California Industrial Plants to Make Asbestos and Acid Products

Huge Expenditures Involved—Quicksilver, Gold, and Chrome Properties Plan Development

OF INTEREST to non-metallic mineral producers is the recent completion of the two units of a roofing manufacturing plant at Pittsburg, Calif., by the Johns-Manville Corporation. Asbestos shingles and pipe insulators are being made. About $2,000,000 is invested in the new manufacturing facilities.

The Stauffer Chemical Company has purchased a twenty-acre tract in the Los Angeles manufacturing area and is to begin the construction of a $750,000 plant for the manufacture of sulphuric acid and caustic soda to serve the oil-refinery trade. The plant output will be 60 tons of caustic per day and 6,000 tons of sulphuric acid per month. Columbia Steel Corporation is financing a $4,500,000 program of expansion.

North Star Tunnel & Development Company, which operated at Tonopah, Nev., has taken over the Reed Quicksilver property in the Knoxville area in Yolo County, Calif. Development work has been started at the property, which is an old one and which made considerable production from 1876 to 1880.

The Reid mine, in the Old Diggings district of Shasta County, Calif., has been sold by a creditors' trustee. The mine supplied low-grade gold quartz to the smelters in Shasta County when they were active.

A new strike of high-grade ore is reported in the Idaho-Maryland mine, at Grass Valley, Calif.

The Royal Development Company is operating twenty stamps at the old Royal property near Hodson, Calif.

Plans are being made for the production of chrome ore on the Sousa ranch, near Yreka, Siskiyou County, Calif. A market for the ore has been found in San Francisco.

Two men equipped with diving apparatus are reported to be searching for placer gold in the Mokelumne River in Amador County. Efforts of a similar nature were tried out in the Feather River several years ago, and deep potholes were worked until a flood carried away the equipment of the operators.

Spain to Manufacture Aluminum

The first aluminum factory in Spain has been established by the Sociedad Aluminio Español S.A., at Sabiñanigo, Province of Huesca, and will soon begin operations, according to *Chemistry and Industry*. The output will at first be 1,500 tons of metal per annum, an amount roughly corresponding to the Spanish consumption, but the 60 Söderberg furnaces installed can produce up to 6,000 tons per annum.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Howey Gold Will Build Mill If Government Develops Power Dam

TORONTO, ONT., Sept. 22, 1928.—J. E. Hammell, president of Howey Gold Mines, in Red Lake, states that if the government makes a start next year on the development of power at the Ear Falls Dam, Howey will build a mill. The power dam is now under construction and will be completed next spring, but the building of a mill will depend upon the construction of a power plant and extension of a transmission line to the mine.

Good progress is being made with the construction of the mill at the Siscoe Gold property, in Quebec. This mill will have a capacity of 100 tons a day and is being constructed by the Southwestern Engineering Company. Completion is expected by the middle of November.

A diamond drill at the Newbec mine, in the Rouyn district, recently cut 11 ft. of massive chalcopyrite and pyrrhotite at a depth of 260 ft. This ore was cut 400 ft. east of the shaft, and the drill is now being moved 100 ft. still further east. A new mining plant is being erected, which should be in operation by the middle of October. Newbec also controls Lartic Mining, where several favorable discoveries have recently been made. The shaft at this property is already down 100 ft.

IN ACCORDANCE with the cooperative arrangement made between Wright-Hargreaves and Lake Shore Mines, development of the extreme westerly part of the Wright-Hargraves property is to be undertaken from the Lake Shore ground. Recent diamond drilling at the Wright-Hargreaves is reported to have revealed three narrow but rich veins. The ore intersections were obtained near the 1,750 level.

Cold Lake Mines Company has taken over the Copper Mining group of nine claims, situated at Second Cranberry Lake. Eight test pits have already been sunk on several showings. The company will conduct an active campaign of exploration.

Amity, operating in the Boston Creek area, has started drifting on the 375 level. Ore from this drifting is being prepared for shipment to the Horne smelter, at Noranda, making the eighth shipment from the Amity. The management is planning the erection of a 100-ton mill to treat the ore, which contains copper and gold.

Red Mammoth Gold Mines, Ltd., which owns a property of 2,500 acres on the northeast shore of Red Lake, has sunk a shaft for 25 ft. by hand steel. A small mining plant has been installed. Considerable free gold has been found in the dolomite, and some mineralization also occurs in the tourmaline, which has been traced for over half a mile. Another showing about 1,300 ft. north of the shaft has a width of about 30 ft. and has been traced for 300 ft.

Melbourne Letter

BY PETER G. TAIT
Special Correspondent

Broken Hill Smelters Buys Hampden Cloncurry Copper Mines

MELBOURNE, Aug. 22, 1928.—Confirmation has been received of the purchase by Broken Hill Associated of the properties of Hampden Cloncurry Copper Mines, Ltd., and of important holdings in Electrolytic Refining & Smelting and Metal Manufacturers, Ltd. Imperial Chemical Industries, Ltd., British Aluminum, Electrolytic Zinc, and National Smelting were associated with Broken Hill Smelters in the purchase of the shares in Metal Manufacturers.

Broken Hill Smelters, which operates the Port Pirie silver-lead smelters, previously purchased Mount Morgan Gold Mining's holding in Electrolytic Refining & Smelting, whose main business in the past has been the treatment of copper-gold ores and refining of copper, and now holds a controlling interest in the company. Inasmuch as copper mining is at a low ebb in Australia, it is not clear whence they will draw their supplies in the future, especially since Mount Lyell has erected its own electrolytic refinery.

HAMPDEN CLONCURRY COPPER MINES owns a number of mines near Cloncurry, in northern Queensland. The estimated ore reserves on Aug. 31, 1925, the latest estimate available, amounted to 135,000 tons of ore, containing 7,119 tons of copper. In addition there were about 70,000 tons of low-grade material, which might be worked at a profit. A smelting plant with a total capacity of 375 tons a day was erected, but it has not been used since 1920.

The fact that Broken Hill Smelters, heretofore mainly concerned with silver and lead, should acquire these interests in copper indicates a desire to become the controlling authority in Australia in the treatment and marketing of all metals.

Broken Hill Proprietary has entered into a contract with the Coppee company, of Great Britain, for the erection of modern coke ovens and a new by-product plant at that company's Newcastle iron and steel works in New South Wales. Additional capital expenditure on other sections of the plant is also foreshadowed.

London Letter

BY W. A. DOMAN
Special Correspondent

Extraction of 70 per Cent Platinum Claimed for C. M. & I. Process

LONDON, Sept. 11, 1928.—Interest in platinum companies has been revived by the statement of the Central Mining & Investment Corporation, referred to last week, that its metallurgists have "solved the problem of platinum concentrates reduction." The process concerns sulphide norite ores—the class of ore that will probably provide the bulk of the tonnage for treatment at the South African platinum properties. They occur in bodies of average regularity and disposition. It is claimed that by precipitation following chlorination from 70 to 75 per cent of the platinoid content of the original ore can be extracted in a form suitable for refining. The metallurgists are satisfied that these processes "can be operated on a commercial scale at reasonable cost," and consequently become of immediate importance. Any gold contained in the chlorination residues can easily be recovered by the use of cyanide.

IN THIS connection it should be mentioned that the Chemical & Metallurgical Corporation is already treating various platinum ores on a small scale at its works at Runcorn, on the Manchester Ship Canal; in fact, it is officially stated that this company has a superior process, and is now ready to treat ores delivered to it. As there seems to be a large supply of raw material, both processes will probably be used.

At the shareholders' meeting of the Southern Rhodesia Base Metals Corporation there was anything but harmony. Those who paid £6 or more for their shares criticized results acrimoniously, and called either for the resignation of the board or for the winding up of the company's affairs. Interested parties, it was alleged, had made large profits, whereas the genuine shareholders had suffered heavy losses. The chairman pointed out that there were yet possibilities, and the company is to be given another chance.

A sensation was created in the Kaffir market by the passing of the dividend by the Rand Selection Company. It was supposed to have a dividend fund of £250,000, and the Anglo-American Corporation was, it was understood, prepared to finance it up to £1,000,000. Consequently, shareholders could not understand why no dividend is payable. The directors explained that the money was required to finance other properties without stating what those propositions were. From a report that reaches me, the explanation is that the directors have bought the Dunkelsbuhler interest in the diamond syndicate.

Societies, Addresses, Reports

Better Business Bureau Official Urges Fair Consideration of Speculative Mining Ventures

SPEAKING at a conference of the Better Business Commission in Chicago recently, Perry N. Moore, financial manager of the Better Business Bureau of Denver, Colo., stated that his bureau had not unearthed so many crooks as one might suppose. An analysis of about 60 mining promotions investigated by the bureau showed only 16, or 27 per cent, as possibly fraudulent; 9 to 15 per cent that appear to have good prospects for success; 4 to 7 per cent that are defunct, and about 50 per cent of the total that are undoubtedly being honestly promoted, but are postulated on hearsay, insufficient facts, hunches, or even on theories directly opposed to scientific knowledge. In these latter the officials of the bureau are forced to the assumption that the promoters are absolutely sincere in their beliefs, no matter how mistaken they may be in the theories. They have found cranks, rather than crooks. Mr. Moore continues:

"You may well ask: 'Is it not just as important to protect the investor against cranks as it is against crooks?' Of course it is, but we can only do that by presenting facts and analyzing theories. Should we express an opinion which later proves erroneous regarding an honest but apparently misled promotion, we would immediately become the object of broadcast accusations of bias, seriously impairing our usefulness. We must shun opinion. To obtain the sanction and approval of your Securities Commissioner, or in making a bureau report, we suggest the following considerations for mining promotions:

"1. *Honesty of Conduct*—This applies to the personal reputation of the promoter as well as to his conduct of any one particular promotion.

"2. *Promotion Stock Allotment*—This is a very debatable phrase, but in this connection it should be interpreted as any stock issued or issuable for promoting, organizing, services, or for any property or leases the true cash value of which is not readily ascertainable. It is a matter of interpretation in each individual instance. Take promissory notes, for example. In one case such a note may be valueless or very dubious, and if it is assigned to a corporation for stock, that would rightly be termed promotion stock. On the other hand, a note may be just as good as its face value indicates, and the issuing of stock therefor is equivalent to stock paid in by cash.

"No criterion can be laid down governing the amount of promotion stock that should be issued. Certainly 75 per cent is too much. Anywhere from 10 to 50 per cent may be reasonable, depending upon circumstances.

"3. *Bond and Lease or Title?*—It is evident that fee simple title of outright ownership is always more valuable than a mere lease. Hence the permissible amount of promotion stock issuable for former should be greater than for the latter. Calling a lease an option does not change its nature.

"4. *Cost of Selling Stock—How Much Goes Into the Mine?*—This is often one of the greatest causes of failure in mining promotion. Commonly considered as highly speculative, mining stocks are difficult to sell. Commissions as high as 50 or 60 per cent, however, impose too great a burden on the investors' money and should not be permissible; 35 per cent should be the maximum. In general it is to the corporation's advantage to fix the price at which stock is to be sold rather than to sell it outright to a resale agency, whereby all control over that stock is surrendered. The latter method is liable to abuse.

"5. *Geological or Technical Features*—A report by an engineer *not interested in any way in the promotion* should be required. Such a report by a man of recognized standing, with approved education and experience, need not be unduly expensive for the promotion, and if the promoter cannot afford to pay for it, then he is probably insufficiently financed to offer his enterprise to the public on a fair basis.

"6. *Cash Capital*—A promoter should have some cash, or property truly equivalent to cash, in his enterprise before he is permitted to offer it to the public.

"Fair play is an outstanding aim of all Better Business Bureaus. It is only fair, therefore, for bureaus to take an open-minded attitude toward honest mining promotions so long as the speculative nature of the offering is made plain to the prospective investor. It is not fair to assume a critical or unfavorable attitude toward them merely because they are speculative."

Australasian Institute Holds Annual Meeting

Delegates Visit Many Important Industrial Establishments—Geophysical Prospecting and Divining Rod Discussed

THE annual meeting of the Australasian Institute of Mining and Metallurgy was held in Melbourne from Aug. 13 to 17. A. S. Kenyon, in his presidential address, dealt briefly with the divining rod in locating underground water supplies. Prof. J. N. Greenwood, of Melbourne University, delivered a lecture on "The Use of the Microscope in Metallurgy." Broughton Edge, who has come to Australia to supervise the work undertaken by the Commonwealth Council of Scientific and Industrial Research on Geophysical Prospecting, gave a very instructive lecture on this subject. He said that the methods employed had been devised as a result of co-operation between mining men, geologists, and physicists, and, although steady progress had been made during the last twenty years, it was within the last four or five years that the importance of these methods had been appreciated and acknowledged by the mining world in general. He added that, although many of these methods were still in, or had barely emerged from, the experimental stage, a steadily increasing list of important discoveries was attributable to their use—more particularly in Europe and America than elsewhere.

The outings included a visit to the Victorian Electricity Commission's brown-coal mining enterprise at Yallourn, 90 miles from Melbourne, where the manufacture of briquets for household and industrial use and the generation of electrical energy are carried out on a large scale.

Another day was spent inspecting the extensive munition establishments of the commonwealth defense department at Maribyrnong. The works form the nucleus of a complete arsenal which will serve to make Australia self-contained in respect to the manufacture of war munitions. The work of the associated laboratories is organized through the following main divisions: Explosive and ammunition, general chemical, metallurgical, and physical and chemical warfare.

Another day was spent inspecting the fertilizer works of the Mount Lyell Mining & Railway Company and of Cuming, Smith & Company at Yarraville. The various departments included the manufacture of 65-68 per cent sulphuric acid and concentrated sulphuric acid, the manufacture of superphosphate from the raw phosphatic material from Nauru and Ocean Island, and the electrolytic method at the Mount Lyell works for the manufacture from crude sodium chloride of caustic soda, liquid chlorine, and hydrochloric acid.

Personal Notes

J. LESLIE MENNELL, of Toronto, was recently in New York.

T. A. RICKARD has returned to San Francisco from British Columbia.

T. L. GLEDHILL, geologist of the Lindsley interests, of New York, is making an examination of properties, held under option at Oxford Lake, in the northern Manitoba mining area.

A. N. MACINTOSH, of Cananea Consolidated Copper, at Cananea, State of Sonora, Mexico, will do research work in geology at the Michigan College of Mining and Technology after Oct. 1.

GEORGE E. COLE, for a number of years inspector for the Ontario Department of Mines, in charge of the Porcupine district, has resigned to take the position of Chief Inspector of Mines for the Province of Manitoba.

H. J. SHEAFE, formerly superintendent of the Argonaut mine, at Jackson, Calif., who had filed suit against the Argonaut company for breach of contract, recently received a settlement from the company out of court.

N. H. MANDERFIELD, Houghton, Mich., metallurgical engineer and member of the staff of the Michigan College of Mining and Technology, was recently in Idaho. Mr. Manderfield spent considerable time visiting mills in the Cœur d'Alene district.

F. K. BRUNTON, consulting mining and metallurgical engineer, has returned to Tucson, Ariz., after a vacation spent in the mountains of Arizona and on the coast. He has opened an office for general consulting work at 2333 East First St., Tucson, Ariz.

Dr. C. L. MANTELL, consulting chemical engineer, has returned to the Department of Chemical Engineering at Pratt Institute, Brooklyn, for the school year, after serving as assistant editor of *Chemical & Metallurgical Engineering* for the summer months.

G. M. WILES has resigned his position as mine superintendent of the Treadwell Yukon, in the Sudbury district of northern Ontario, which he has occupied for the last three years. VICTOR A. CLAUSEN, who has recently been in charge of milling operation, succeeds him as superintendent.

H. W. ALDRICH, assistant general superintendent of Inspiration Consolidated Copper, at Miami, Ariz., in charge of the leaching plant, was in New York recently en route to Potrerillos, Chile, where he will undertake special work for Andes Copper. He expects to be away from Miami for about three months.

Dr. GRUMBRECHT, rector of the mining school at Klausthal, Germany, one of the world's leading institutions for the study of mining and metallurgy, recently visited the Michigan College of Mining and Technology at Houghton, went underground at the Mohawk mine, and inspected the Mohawk stamp mill at Gay. He is visiting the mining schools and mining districts of this country.

EDWARD J. MEHREN, vice-president and editorial director of the McGraw-Hill Publishing Company, has been appointed editor of the *Magazine of Business*, which recently came under McGraw-Hill control through the consolidation of that organization and the A. W. Shaw Company, of Chicago. The *Magazine of Business* treats of those major developments that affect business in general. It, therefore, has a strong appeal to the policy-forming executives in banking and finance, manufacturing and production, sales and distribution, as well as in the servicing fields, such as transportation, communication, electric light and power. The task of editing such a paper required a broad experience in business, a thorough knowledge of editorial and publishing practice, and acquaintance with the editorial resources of the McGraw-Hill organization. It is for these reasons that Mr. Mehren, who has been with the McGraw-Hill organization for twenty-one years, was selected. He began his publishing career as an associate editor on *Engineering Record*, subsequently becoming editor of *Engineering Record* and of *Engineering News-Record*. For the last five years he has been vice-president and editorial director of the McGraw-Hill Publishing Company. He continues to hold these positions.

EDWARD J. MEHREN

GEORGE R. FANSETT, mining engineer of the Arizona Bureau of Mines of the University of Arizona, has left the university for a trip into the northern part of Arizona. While gone he will speak in the high schools of Winslow, McNary, St. Johns, Snowflake, Show-low, Holbrook, Eagar, and Lakeside, as well as attending to other duties of his office.

Dr. PHILIP J. SHENON, of Salmon City, Idaho, has been appointed assistant professor of geology at the Montana State School of Mines to succeed JOHN T. MCCORMICK, who recently resigned to join the faculty of the University of Arizona. Dr. Shenon received his mining degree from the University of California and the University of Idaho and his doctor of philosophy degree from the University of Minnesota.

RICHARD PEARCE, one of the editors and owners of *The Northern Miner*, of Cobalt, Ontario, has just returned from a 4,000-mile airplane trip to the sub-arctic regions and across the Barren Lands, where some of the most recent exploration has been carried on. The itinerary embraced Norway House, the west shores of Hudson Bay, Chesterfield Inlet, Baker Lake, Dubawnt Lake, Slave River, Lake Athabaska, Reindeer Lake and the Sherritt-Gordon Flin Flon section of northern Manitoba.

WILBUR A. NELSON resigned as State Geologist of Virginia on Sept. 1, 1928. For the last three years, Mr. Nelson had held the joint position of State Geologist and head of the School of Geology at the University of Virginia. Beginning Sept. 1, these two positions have been separated and Mr. Nelson will devote his entire time to his official duties at the University of Virginia. LINWOOD H. WARWICK, who has been chief clerk of the Survey since its organization in 1908, has been appointed acting head of the Virginia Geological Survey, the offices of which will be at the University of Virginia as heretofore.

OBITUARY

J. N. CURTIS, pioneer mining man of Arizona, died at his home, 2163 West 24th St., Los Angeles, on Sept. 17. Mr. Curtis had been an alternate resident of Tucson, Ariz., and Los Angeles for many years. He was 79 years old.

JAMES ALLEN, 81, who went to Colorado in the late 70's from the mines of Michigan and who was very active in Georgetown and Leadville, Colorado mining camps, died in Denver on Sept. 15.

Dr. ALFREDO DELGADO, formerly vice-president of Patiño Mines & Enterprises, died at Oruro, Bolivia, on Sept. 20. Dr. Delgado was for a time associated with the French firm of Bebin Frères at the firm's mine in the Potosi district of Bolivia.

A. S. BIGELOW, former president of the Osceola, Tamarack and Isle Royale mining companies, in the Michigan copper district, died in Boston on Sept. 17. Mr. Bigelow, who was advanced in years, had been an invalid for some time as the result of a stroke of paralysis.

Recent Technical Publications

REPRESENTATIVE INDUSTRIES IN THE UNITED STATES. Edited by H. T. Warshow; Henry Holt & Company, 1 Park Ave., New York. Pages 702. Price $5.

THIS latest addition to the so-called American Business Series of books produced by Henry Holt is really an encyclopedia of information regarding the 21 major industries of which it treats. Those desiring a better understanding of the representative industries of the country might well turn to its pages and read a chapter a week from now until next spring. At the end of that time they would have achieved their wish. The book will be valuable chiefly to those, however, who from time to time find it necessary to familiarize themselves with some particular industry in connection with a problem that has arisen. The text bristles with detail, instructive indeed but not making for light reading. Technical expressions have been avoided by the contributing authors, so the average reader will have no difficulty because of them.

The industries covered include the following: Aluminum, automobile, banking, chemical, construction, copper, cotton, electric, iron and steel, lead mining and smelting; the blue lead and mixed-metals industry; leather, meat-packing, lumber, paint, petroleum, railway equipment, rubber, water power, wool, and zinc. The scope of the book is thus seen to be fully as wide as the title would indicate.

Each chapter has its own author, who in every case is intimately connected with or well posted on the industry of which he writes. The aluminum industry is discussed by Robert J. Anderson, formerly a contributor to "The Mineral Industry" on this topic; copper by F. E. Richter, economist of the American Telephone & Telegraph Company; lead mining and smelting, by the editor himself, Mr. Warshow, who is comptroller of the National Lead Company; and the zinc industry by W. R. Ingalls. An additional chapter or appendix, devoted to non-ferrous metal statistics, is also contributed by Mr. Ingalls.

A. H. H.

MARBLE CREEK BASIN, IDAHO—The University of Idaho, at Moscow, has just issued pamphlet No. 30, containing a paper, by Alfred L. Anderson, entitled "A Geological Reconnaissance in the St. Maries Region, Idaho." The study of this area was undertaken by the Idaho Bureau of Mines and Geology, following the reports of the discovery of lead-silver deposits in the upper Marble Creek drainage basin during the winter of 1927-28. Promising developments had also been reported on Roundtop Mountain, a few miles northeast of St. Maries, and this was included in the study, which was made in July. The most promising field for prospecting seen by the writer during the brief period of his reconnaissance lies north of the St. Joe River between the town of St. Maries and Fitzgerald Creek, and probably extends beyond. In this area is found the combination of factors believed to be most favorable to ore deposition—namely, extensive zones of faulting and igneous intrusion without notable metamorphism. The Roundtop district is worthy of systematic exploration, in the opinion of Mr. Anderson. Prospecting in the Marble Creek area will probably be delayed, he thinks, as the region bears scant evidence of mineralization and is apparently lacking in the structural features that usually control mineralization. It also shows a generally too intense metamorphism to be considered most favorable for ore purposes, especially of lead and zinc.

NEWFOUNDLAND — A. K. Snelgrove, a fellow in geology at McGill University, is the author of a lengthy article entitled "The Geology of the Central Mineral Belt of Newfoundland," which appears in the September issue of the *Canadian Mining and Metallurgical Bulletin*. The paper, which is a thesis submitted for the degree of Master of Science, is accompanied by several maps. It covers 70 pages. In conclusion, the author says that the central mineral belt combines, in a very compact manner, the three possibilities sought by mining engineers—namely, new ore in old mines, new mines in old districts, and favorable prospecting grounds in practically unexplored regions. The conditions affecting exploration, he says, leave little to be desired.

MINING BY FIRE — The new method of breaking rock by fire, recently introduced on the Rand, is the subject of two articles in current periodicals. One of these appears in the *Canadian Mining Journal* of Aug. 31, which devotes a page to describing the apparatus and the advantages claimed. The other is published in the *Mining and Industrial Magazine of Southern Africa*, for Aug. 8. The latter issue prints a communication from Prof. Bohuslav Stoces, of the School of Mines at Pribram, Czechoslovakia, who states that he is the inventor of the process of applying flame to modern rock-breaking methods in mining, and not a certain gentleman from Munich. Dr. Stoces is the author of a book entitled "Anwendung der Feuermethode in Modernen Bergbau."

SAMPLING A TAILING POND — The *Proceedings*, dated June 30, 1928, of the Australasian Institute of Mining and Metallurgy, contain a fourteen-page article entitled "Boring a Slime Dam," by I. W. Morley. An account is given of work done by the author for the purpose of sampling a slime dam on the leases of the North Mount Farrell Company at Tullah, Tasmania, during the summer of 1925-26. The purpose was to obtain samples for assay with a view to possible re-treatment by flotation.

IRON MINING, SPAIN—Jose Balzola is the author of a paper entitled "Iron Ore Mining in Vizcaya," which is to be presented at the next annual meeting of the Iron and Steel Institute, England. The author, who is a mining engineer at Bilbao, states that in his paper he simply brings an earlier one by the late William Gill up to date. The paper, an advance copy of which has been received, is well illustrated with drawings and halftones. It contains 38 pages.

MICA—*Commerce Reports* for Sept. 10, 1928, contains a one-page article entitled "Direct Purchase of Madagascan Mica." The author says that the mica situation in Madagascar from the point of view of American purchasers warrants special attention. It has been found difficult for American firms at such a distance, and in view of the colonial conditions, to obtain satisfactory local connections.

Government Publications

The following government publications have been received:

"Barium Carbonate." A report of the United States Tariff Commission. U. S. Government Printing Office. Pages 18. The summary says that the present duty on barium carbonate does not equalize differences in cost of production. The commission states that the rate of duty necessary to equalize these differences is 1½c. per pound. The pamphlet concludes with the proclamation of the President increasing the duty on barium carbonate, precipitated (within the limits of total increase provided for in the act of Sept. 21, 1922) from 1c. per pound to 1½c. per pound.

"The Sulphur Problem in Burning Coal," by J. M. Barkley. Technical Paper No. 436, Bureau of Mines. Pages eight. Price 5c.*

"Graphite in 1927." By Jefferson Middelton. An advance copy of "Mineral Resources of the United States in 1927, Part 2." Pages eight, Price 5c.*

"Preliminary Summary, Mineral Resources of the United States in 1927." Published by Bureau of Mines, Washington, D. C. Pages 120. Price 20c.*

"Fuel Briquettes in 1927," by F. G. Tryon and J. M. Corse. An advance copy of "Mineral Resources of the United States in 1927, Part 2." Pages eight. Price 5c.*

"Fluorspar and Cryolite in 1927." By Hubert W. Davis. An advance copy of "Mineral Resources of the United States in 1927, Part 2." Pages 18. Price 5c.*

"Production of High-Alumina Slags in the Blast Furnace." By T. L. Joseph and C. E. Wood. Technical Paper 425. U. S. Bureau of Mines. Pages 32. Price 15c.*

*Sold only by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

MARKET AND FINANCIAL NEWS

Phelps Dodge and Nichols Sales Agencies Merge Oct. 1

PLANS announced several months ago, involving the merging of the copper sales agencies in New York of the Nichols Copper Company and the Phelps Dodge Corporation, will take effect on Oct. 1. The new agency will be called Phelps Dodge Sales Company, Incorporated, and will have offices on the fourth floor of the building occupied by the Phelps Dodge Corporation at 99 John St., the selling being under the immediate direction of Charles A. Austin, Martin H. Crego, and his assistant, Robert Conklin. The officers of the company are: Walter Douglas, chairman; C. Walter Nichols, president; Gordon R. Campbell, vice-president; A. T. Thomson, secretary and treasurer; Walter C. Bennett, chairman advisory committee; Charles A. Austin, manager of sales; and Martin H. Crego, assistant manager of sales. Messrs. Douglas, Nichols, Campbell, and Bennett, and Cleveland E. Dodge are the directors.

The new sales agency is controlled by four producing copper companies: Phelps Dodge Corporation, Nichols Copper Company, Calumet & Arizona Mining Company, and Old Dominion Company. It will market the copper produced by Phelps Dodge, Calumet & Arizona, Old Dominion, Nichols, United Verde Extension, Arizona Commercial, Ducktown, and Granby. New Cornelia, being a subsidiary of Calumet & Arizona, would normally be included, but it is tied up by a sales contract with the Metals Sales Corporation that does not expire until the middle of 1930. The new sales agency will have about 15,000 tons of copper a month to dispose of in the domestic market, making it second only to Guggenheim Brothers in the volume of copper available for sale each month.

American Zinc Institute Issues August Sales Report

THE Slab Zinc Producers Committee of the American Zinc Institute has issued the following weighted average report of sales of Prime Western and Brass Special zinc during August, as reported by the following companies: American Metal, American Smelting & Refining, American Zinc, Lead & Smelting, Athletic Mining & Smelting, Eagle-Picher Lead, Federated Metals, Grasselli Chemical, Hegeler Zinc, Illinois Zinc, Matthiessen & Hegeler Zinc, National Zinc, and Quinton Spelter. The report does not include producers of High-Grade zinc or secondary zinc, nor all producers of Prime Western. Such, for example, are the Anaconda company, sellers of electrolytic zinc; New Jersey Zinc, which produces High-Grade zinc and rarely sells any Prime Western; the United States Steel Corporation, which uses all of its own production of Prime Western; and the Weir Smelting Company.

August Sales

	Tons Sold	Weighted Price East St. Louis Basis
For August delivery:		
Prime Western..	6,360	$0.06251
Brass Special...	789	0.06360
For subsequent delivery:		
Prime Western..	11,985	$0.06252
Brass Special...	1,239	0.06359

It is understood that the average price is slightly above the generally recognized level of 6.25c. on account of the inclusion in the weighted average of some sales of selected Prime Western zinc, on which a small premium is charged. Similar reports will be issued in future on or about the 15th of each month.

New Tri-State Freight Rates Effective on Oct. 10

The new freight-rate schedule to become effective Oct. 10 puts all Oklahoma and Kansas points in the Tri-State district on one level, giving a rate heretofore limited to Quapaw, Okla., Baxter and Lawton, Kan., and Missouri points. The new producing points included will benefit approximately 45c. per ton on shipments east of the Mississippi River. It is presumed that smelters have withheld purchases of reserve supplies until the new rate is in effect. As few have a satisfactory reserve stock at present, some furnaces may be "dead fired" in the interim. This will bring an essential restriction of metal production, along with the restricted ore output, that should add strength to the slab-zinc market.

YUKON GOLD COMPANY, a Guggenheim organization operating tin dredges in the Federated Malay States, and controlling operations of the Elkoro Mines Company in Nevada, and Keno Hill, Ltd., a silver-lead property in the Mayo district, Yukon Territory, reports net profit of $334,870 for the year 1927.

Anglo-Oriental Merges More Tin Interests

CONSOLIDATION of sundry important Malayan tin-producing companies has just been concluded under the auspices of the Anglo-Oriental Mining Corporation, with a view to arranging for single technical direction and a co-ordinated policy in the marketing of output.

It is understood that these companies will control approximately 12 per cent of the total world output of tin. Earlier in the year a large number of Nigerian companies controlling 65 per cent of the Nigerian output were absorbed into a single group called the Associated Tin Mines of Nigeria, with a single sales and technical organization. Since then the Anglo-Oriental group, which controls this merged group, has been drawing together a large number of concerns in Burma, Siam, and Malaya into a single co-operating organization called the Anglo-Oriental (Malaya), Ltd. The marketing of a considerable proportion of the world's virgin tin supply will in effect be in the hands of three great combines, the Dutch, the Patiño interests and the Anglo-Oriental group.

Ontario Gold Production Records Increase for August

THE Ontario Bureau of Mines report of the gold production for August showed a considerable advance over the record for the previous month, the recovery being $2,721,098. Porcupine mines treated 279,500 tons and recovered $1,737,344. Kirkland Lake mines treated 86,788 tons and recovered $983,754. During the first eight months of the year the total recovery was $21,246,000. This favorable showing is to be credited to Kirkland Lake, which shows an increase of $2,200,000, compared with the first eight months of 1927.

FRENCH INDO-CHINA production of metals and minerals for the first six months of 1928 are compared with the outputs during the corresponding period of 1927 in the following table. All figures represent metric tons except those for gold and silver which are in kilograms, and those for gem stones are in carats.

	January to June Inclusive 1928	1927
Zinc	10,000	12,000
Tin	419	330
Lead	36	50
Silver	112	150
Tungsten (WO_3 content)	46	54
Gold	4	4
Phosphate	5,000	12,000
Graphite	300	300
Gem stones	1,335	1,500

Ontario Metal Production at Higher Rate in First Half of 1928

THE REPORT of the Ontario Department of Mines, covering the mineral production of the province for the first six months of 1928, shows a total value of $50,218,910, as compared with $45,103,223 for the corresponding period of the previous year. The metallic production amounted to $34,089,000, as compared with $30,967,000, the greater part of the increase being due to greater production of nickel and copper. The chief metallic products for the period are tabulated in the accompanying table which compares, also, the relative values for 1927 and 1928.

Metallic Product		1927	1928
Gold, oz	765,753	$15,824,821	$15,971,938
Silver, oz	5,071,363	2,874,433	2,040,670
Platinum metals, oz	11,170	740,486	625,045
Copper, metallic and in concentrates, lb	10,205,590	1,301,592	2,477,479
Copper in matte exported, tons	5,801	1,160,288	1,307,067
Nickel in matte exported, tons	7,892	2,841,013	3,518,203
Cobalt, metallic, and metallic contents of oxides, salts and material exported, lb	392,837	765,748	822,603
Nickel, metallic, lb	15,318,999	4,078,346	5,612,032
Nickel oxide, lb	4,690,292	1,093,637	1,476,570

Nevada Metal Production Declined in 1927

Statistics compiled by U. S. Bureau of Mines, showing production of gold, silver, copper, lead, and zinc in Nevada, by counties, during 1927, have just been released. Tonnage of ore treated, in 1927, decreased from the total for 1926 by 353,416 tons. Quantity and value of the various metals, except copper, declined, likewise. Increase in the production of copper was effected by improved operating conditions at the Nevada Consolidated Copper Company's Ruth mine. The statistics follow:

County	Producers	Ore Treated, Tons	Gold (a) Ounces	Silver (a) Ounces	Copper Pounds	Lead Pounds	Zinc Pounds	Value
Churchill	7	368	60	7,078	443	142,859	.....	$14,319
Clark	24	11,469	1,286	15,843	9,879	1,690,443	3,546,078	370,316
Douglas	4	54	31	1,222	.....	13,075	.....	2,159
Elko	39	56,279	24,271	302,480	327,329	2,372,428	40,197	868,160
Esmeralda	39	220,759	22,643	1,117,058	2,252	152,237	3,142	1,111,543
Eureka	13	50,888	2,866	619,883	52,758	2,440,127	.....	571,379
Humboldt	12	520	187	10,806	595	5,854	.....	10,442
Lander	32	32,846	1,245	801,938	1,367,637	402,496	20,510	686,278
Lincoln	10	42,001	762	380,112	1,434,702	3,938,036	2,438,395	823,392
Lyon	22	427,000	1,668	54,671	9,518,447	3,486	.....	1,312,628
Mineral	42	8,500	2,160	117,490	48,962	654,930	285,406	177,221
Nye	69	79,374	30,722	1,527,312	37,880	2,401,916	.....	1,657,361
Ormsby	1	8	1	524	240	.....	.....	347
Pershing	22	25,419	2,430	168,327	552	96,972	.....	151,861
Storey	20	81,827	11,401	62,051	1,100	.....	.....	271,017
Washoe	13	348	402	3,796	420	11,269	1,191	11,320
White Pine	40	4,493,492	48,203	206,588	107,456,080	1,458,690	9,604	15,282,846
Total 1927	409	5,531,152	150,346	5,397,179	120,259,276	15,784,818	6,344,523 (b)	23,322,589 (b)
Total 1926	405	5,884,568	175,381	6,518,983	101,827,937	22,367,965	10,817,833	24,549,991 (c)

(a) Includes placer production. (b) Average value of metals: Gold, $20.67 per ounce; silver, 56.7c. per ounce; copper, 13.1c. per pound; lead, 6.3c. per pound; zinc, 6.4c. per pound.
(c) Average value of metals: Gold, $20.67 per ounce; silver, 56.24c. per ounce; copper, 14c. per pound; lead, 8c. per pound; zinc, 7.5c. per pound.

Hollinger Dividend Reduced

DIRECTORS of Hollinger Consolidated Gold Mines, Ltd., in Porcupine, at their meeting in Montreal a few days ago cut the dividend from 26 to 13 per cent a year. This dividend will be payable at the rate of 1 per cent every four weeks, instead of 2 per cent formerly. This is the first reduction in the dividend rate since the company began payments in 1912, in which year $270,000 was paid. Dividends to date amount to $47,600,000. The directors consider there will be no difficulty in earning profits sufficient to maintain the decreased dividend rate. Mention is also made that the directors are negotiating with the T. N. & O. Railway regarding a branch line in the Kamiskotia field, where the company has developed a considerable tonnage of comparatively low-grade copper ore.

SAN FRANCISCO MINES OF MEXICO, LTD., reports results of operations for August as follows: Ore treated, 26,690 tons; lead concentrates produced, 3,412 tons; zinc concentrates produced, 4,288 tons. Estimated net smelter returns were $273,218 and operating expenses $130,651. Estimated operating profit was $142,567.

The return includes a plus adjustment of $3,405, being the excess of realizations of products over valuations in respect of previous months.

BENGUET CONSOLIDATED MINING COMPANY, operating a gold and silver property in the Philippine Islands, milled 44,900 tons of ore during the first six months of 1928. The average value of the gold and silver content of the ore was 24.87 pesos per ton. Net profit for the period was 260,053 pesos. Tonnage of ore reserves on June 30, 1928, was approximately the same as at the beginning of the year, but owing to the extraction of low-grade and the development of high-grade ore, the gross value is greater by approximately 1,000,000 pesos. A dividend of 5 centavos per share was paid March 31, 1928. Since then dividend payments have been omitted because of heavy expenditures for development work.

Analysis of Productive Operations Index

RECEIPT of revised statistics of domestic silver production for July occasioned a recalculation of *Engineering and Mining Journal's* Index of Productive Operations in Non-Ferrous Metal Mining Industries in the United States. The revised figure is 93.8, the lowest point the Index had reached since July, 1927, and offers additional confirmation of the contention that the July sag in domestic non-ferrous metal production is a usual occurrence.

The recovery in rate of output for August, however, is more material than usual. An advance over the July Index number to 100.9, of more than 7 per cent—7.1 points to be exact—is accounted for by higher productive outputs of all the metals included in the Index. Production of copper by United States smelters is higher by approximately 5½ per cent; primary output of pig lead increased 11 per cent in round numbers; the production of slab zinc was higher by something like 2½ per cent; and of bar silver by nearly 15 per cent. Thus it may be seen that lead and silver experienced the more pronounced reactions to the July decline in rate of productive operations.

Improvement in copper was not unexpected. Increased consumptive demand in recent months has made a generally increased rate of production imperative. In view of recent market activities, it is not improbable that the unavoidable decrease in production in July had considerable influence in convincing consumers that producers were not in position to increase production as readily as had been expected.

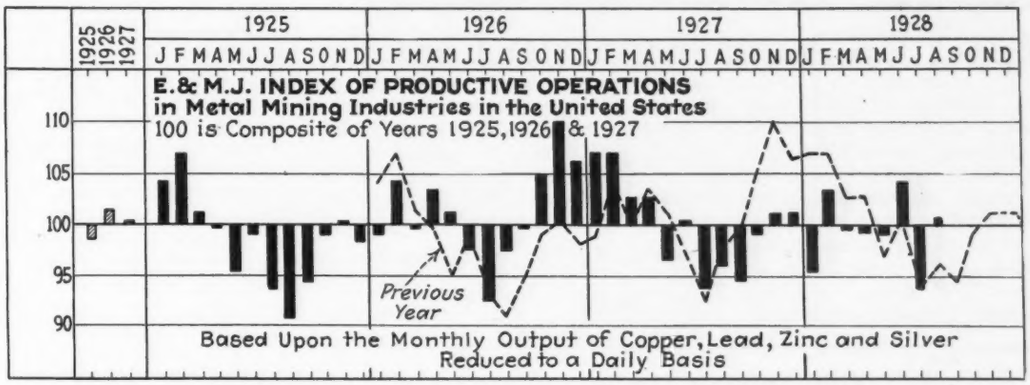
A large part of the increase in production during August is accounted for by the porphyry producers; output of the Lake mines was virtually unchanged; the vein mines, prominently represented by Anaconda's Butte properties, registered a normal increase in production. Production from custom ores continues to increase, and imports of ore, matte, and other copper-bearing material for smelting purposes will probably show an appreciably higher rate than in July.

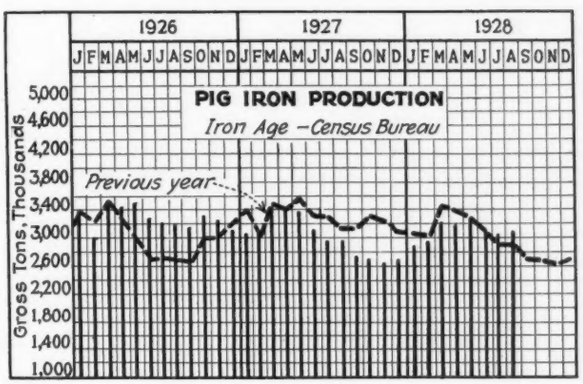
Lead production in the Tri-State district declined appreciably in August, but Utah's contribution for the month was much heavier, and a corresponding increase was probably experienced by the Cœur d'Alene producers.

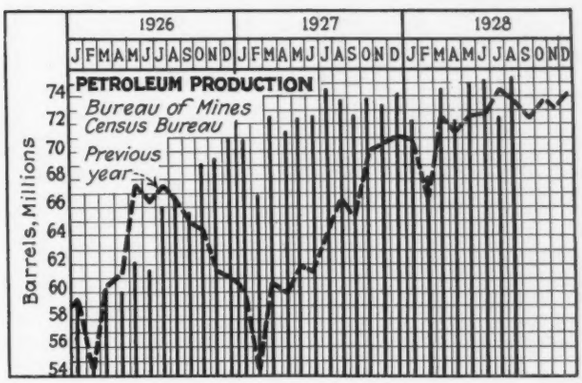
Production of slab zinc from the Tri-State district advanced, and it is probable that the rate of output of many of the complex-ore producers showed a corresponding advance. Total output of bar silver is controlled largely by the silver content of unrefined bullion and the operative rate of the copper and lead refineries. Consequently, the rate of mine operations or the source of such silver supply is not immediately reflected in the monthly production statistics.

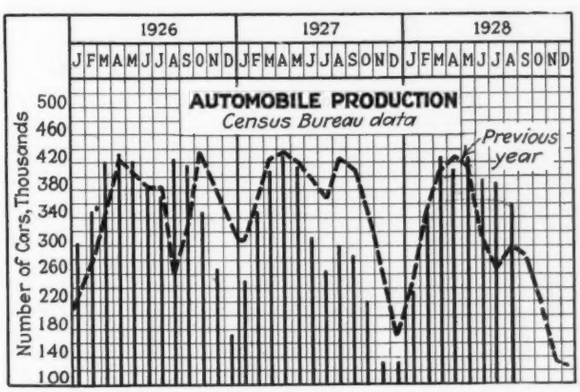
Indicators of Industrial Activity

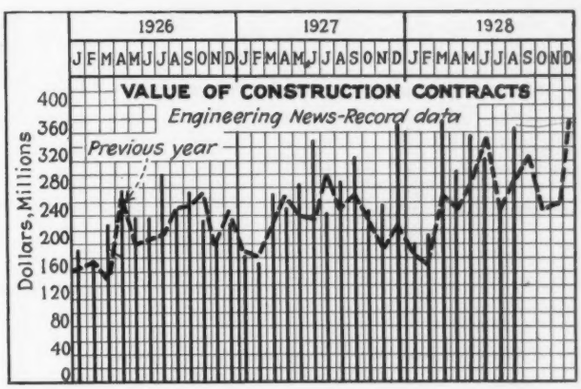
of Significance to Mining

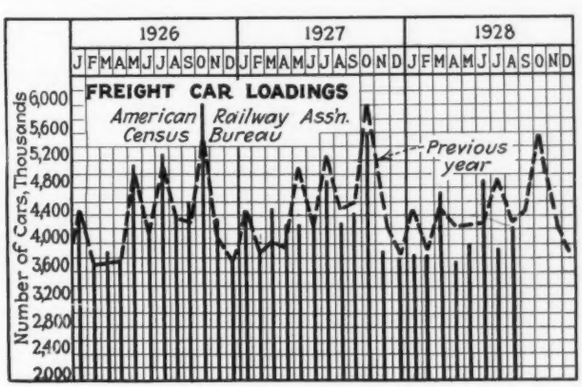


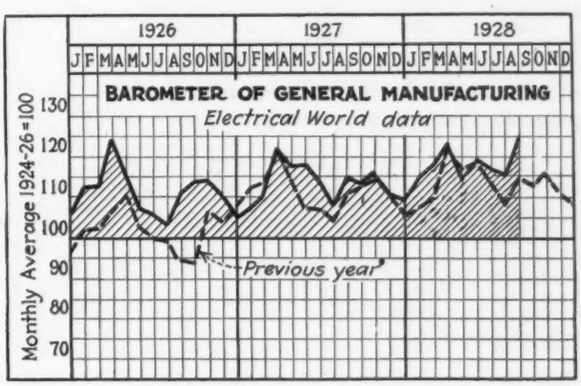












The Market Report

Copper Up Another Quarter Cent

New York, Sept. 26, 1928.—Activity in copper and a further advance in the domestic market from 15c. to 15¼c., Connecticut, has been the feature of the non-ferrous metal market this week. Lead has continued in good demand at unchanged prices. Zinc has been quiet, with sellers firm at 6.25c., St. Louis, for all positions. Tin prices advanced slightly on better demand from speculative quarters, whereas silver has softened with the withdrawal of support from China. The activity in copper and lead is interpreted as reflecting keen demand for fabricated products on the part of ultimate consumers.

Copper Active at Higher Prices

Though the total volume of sales of copper during the week has been somewhat lower than the record-breaking totals of the two preceding weeks, it was still approximately three times as great as a normal week's business. It is true that considerably more than half brought only 15c., delivered, but at the same time a substantial tonnage has been sold on the basis of 15¼c. since Monday, on which day all producers had increased their price to that level. Several transactions on Friday were closed at 15¼c., Connecticut, and 15⅜c. in the Middle West. On the other hand, one or two sellers traded in large volume on both Friday and Saturday at 15c. and 15⅛c. The absence of business at higher levels on Saturday accounts for the apparent reaction indicated by the quotation on that day. November and December deliveries, with the latter predominating, were specified. The foreign price of the Export Association was not advanced from 15.25c. to 15.50c., c.i.f., until Monday, so that for a couple of days foreign buyers were favored with cheaper copper than consumers in the domestic market. Two factors may be mentioned in connection with the phenomenal volume, estimated at about 500,000,000 lb., for foreign and domestic delivery sold during September. A great many buyers doubtless had reached the conclusion that the 14.75c. level would not be passed, and allowed their supply to dwindle to a minimum. When, in the face of substantial buying, producers advanced their price to 15c., consumers were panic stricken and endeavored—apparently with some success—to meet their needs farther ahead. Coincidently, the customers of the fabricators saw the price advance and promptly flooded them with orders, thereby adding to the requirements for refined metal.

Lead Continues Active

Though the sales of lead in the week ending today do not equal the total of last week, the market, nevertheless, has been active, and considerably more lead has been sold than has been produced in the same period. Some sellers have done even a better business than last week. Prices are entirely unchanged: the New York market is uniformly at 6.50c. for all positions, that also being the level set by the American Smelting & Refining Company for contract business, whereas the St. Louis market has been 6.325c. for prompt and October shipment, and 6.35c. for November. Last Thursday most of the business was for November, but since then sales for that position have only been occasional. In the last day or two, a resale lot was reported offered for 6.30c., but the market as quoted by producers this afternoon closes strong at full prices.

Demand has been general, though corroders have not been heard from to any extent, the paint business apparently not being quite up to what it was this time last year.

No complete report of the action of the lead conference in London last week is yet available, but it is understood that so long as lead sells at from £20 to £23 per long ton no action will be taken on changing production rates.

Daily Prices of Metals

Sept.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
20	14.775	47.75	6.50	6.35	6.25
21	14.775@15.025	48.875	6.50	6.325	6.25
22	14.775@14.90	49.00	6.50	6.325	6.25
24	15.025	49.00	6.50	6.325@6.35	6.25
25	15.025	48.75	6.50	6.325	6.25
26	15.025	49.00	6.50	6.325	6.25
	14.931	48.729	6.500	6.331	6.250

Average prices for calendar week ending Sept. 22, 1928, are: Copper, 14.806; Straits tin, 48.208; N. Y. lead, 6.500; St. Louis lead, 6.333; zinc, 6.250; and silver, 57.167.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
20	64 1/16	64 1/8	70 1/2	216 3/4	213 3/4	22 1/8	21 13/16	24 3/8	24 1/2
21	64 7/16	65	70 3/4	219 1/2	214 3/4	22	21 11/16	24 3/8	24 1/2
24	64 1/2	65 1/4	71 1/4	220 1/8	215 1/2	21 15/16	21 11/16	24 5/16	24 7/16
25	64 3/8	65 1/4	71 1/4	223 1/2	219	21 11/16	21 7/16	24 5/16	24 7/16
26	64 9/16	65 1/8	71 1/4	223	218 1/2	21 3/4	21 1/2	24 1/8	24 5/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
20	4.84 9/16	57 1/4	26 1/4	84s11½d	24	4.84½	57 5/8	26 7/16	84s11½d
21	4.84 5/8	57 3/8	26 5/16	84s11½d	25	4.84 9/16	57 1/8	26 5/16	84s11½d
22	4.84½	57 5/8	26 7/16	.	26	4.84¼	57	26 1/4	84s11½d
					Avg.		57.333		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pense per troy ounce of sterling silver, 925 fine. Sterling quoations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Should it fall below or rise above those figures, efforts might be made at curtailment or expansion of foreign operations. Students of the lead market on this side do not look for any early disturbance of the status quo.

Though recent domestic sales have been greater than production, it is thought that this condition is a temporary one. Anyway, stocks remain ample to take care of a continued active demand.

Zinc Continues Quiet

The zinc market has been featureless, with galvanizers showing no great inclination to buy and producers holding firmly at 6.25c. for delivery any time during the remainder of the year.

Tin Touches 49c.

Dealers have been actively in the market for tin for forward delivery this week, shoving the price up, but consumers have taken only moderate tonnages. It is thought here that the Anglo-Oriental group in London is boosting the market to help float a security issue, and that prices are likely to decline around the first of the year. Straits shipments are expected to be about 8,250 long tons this month, but next month seems likely to be greater. Forward deliveries have ruled about half a cent less than prompt, which has hovered around 49c. for the last four days. The 99 per cent grade is very scarce.

Sterling Continues Low

Sterling is still at or near the gold point, but gold is not being imported from London. Closing cable quotations on Tuesday, Sept. 26, follow: Francs, 3.90¾c.; lire, 5.22⅞c.; and marks, 23.84c. Canadian dollars, par.

Silver Quiet and Weak

Buying for China account advanced prices during the first half of the week, but the market weakened on Sept. 25 when support from that quarter was withdrawn, resulting in a decline in the New York quotation of ½c. per ounce. The closing tendency is quiet and uncertain.

Mexican Dollars (Old Mexican pesos): Sept. 20th, 43⅜c.; 21st, 43½c.; 22d and 24th, 43¾c.; 25th, 43½c.; 26th, 43⅛c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

Antimony—Per lb., duty paid, New York; Chinese brands, 10⅞@11c. per lb. for spot, 10⅝@10¾c. per lb. for futures. Rather more activity. Cookson's "C" grade, spot, 15⅜c.

Bismuth—Per lb., New York, in ton lots. $1.70. Smaller lots, $1.85 and up.

Cadmium—Per lb., New York: 75c.; good demand.

Iridium — Per oz., $285@$300 for 98@99 per cent sponge and powder.

Nickel—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

Palladium — Per oz., $42@$46. Small lots bring up to $50.

Platinum—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $73.50@$74 bid, $75@$76 asked. Quiet.

Quicksilver — Per 76-lb. flask. $128 to $129, cash. Small lots command about $131. Market more active. San Francisco wires $131.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Sept. 8.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N. Y.; Wolframite, $10.80@$11; Western scheelite, nominal.

Chrome, Iron, Manganese, Tantalum, and Titanium ores are unchanged from quotations in the Sept. 8 issue.

An Effective Shutdown in the Tri-State

Joplin, Mo., Sept. 22, 1928

Blende

		Per Ton
High		$42.80
Premium blende, basis 60 per cent zinc	$40.00@	41.00
Prime Western, basis 60 per cent zinc		40.00
Fines and slimes, 60 per cent zinc	36.00@	39.00
Average settling price, all zinc		39.65

Galena

High	$86.00
Basis 80 per cent lead	85.00
Average settling price, all lead	83.54

Shipments for the week: Blende, 8,175; lead, 1,954 tons. Value, all ores the week, $487,390.

Seventy-three mills were closed down all of this week. Forty-eight continued in operation, a third of which were tailing mills. A number of the mine mills in operation this week will close down next week. Others will continue mining this month and close down all of October.

Production was 4,600 tons, against a normal output of approximately 13,000 tons per week. It was the most successful effort at restriction of the output ever undertaken, and suggests that the producers are awake to the necessity of limiting the output to the average demand, or 11,330 tons per week, based on the average shipments of the eight months ended with August.

Galena was advanced to a basis price of $85 per ton of 80 per cent lead content, an advance of $2.50 per ton.

Platteville, Wis., Sept. 22, 1928

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$82.50

Shipments for the week: Blende, 654 tons; lead, none. Shipments for the year: Blende, 26,986 tons; lead, 1,445 tons. Shipments for the week to separating plants, 1,064 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Sept. 8 issue.

Metallic Compounds

Arsenious Oxide (White Arsenic)—Per lb., 4c. Considerable business reported.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Sept. 8 issue.

Alloys

Ferromanganese—**Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $33 f.o.b. furnace.**

Nickel Silver—Price advanced from 30 to 30¼c. per lb. for 18 per cent nickel Grade A sheets, effective Sept. 24.

Yellow (Muntz) Metal — List price advanced from 20½ to 20¾c. per lb. for dimension sheets, and from 17½ to 17¾c. per lb. for rods, effective Sept. 24.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon. Ferrotitanium, Ferrotungsten. Ferrovanadium and Monel Metal are unchanged from prices in the Sept. 8 issue.

Rolled Metals

Copper Sheets—F.o.b. mill, price advanced from 23¾ to 24c. per lb. for hot-rolled sheets, and from 16⅞ to 17⅛c. per lb. for wire, effective Sept. 24.

Lead and Zinc Sheets are unchanged from prices in the Sept. 8 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Sept. 8.

Iron, Steel, and Coke

Iron—**Per gross ton, Valley furnaces. Bessemer, $17.25@$17.50; basic, $16.25 @$16.50; No. 2 foundry, $17.**

Steel—**Base prices per gross ton. Pittsburgh, billets and slabs, $33; plates. structural shapes, and soft steel bars, per lb., 1.90@2c.**

Coke — Per gross ton, Connellsville furnace. $2.75@$3. Connellsville foundry, $3.75@$4.85. By-product coke. Ohio and Kentucky. $7: Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended Sept. 22, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	82⅜	7⅛	81⅛	Jl.14, Au. 20 Q	1.00
Aris. Com'l	Boston	5⅛	5¼	5¼	Jl. 16, Jl. 31 SA	0.25
Cal. & Aris	New York	114½	108	111	Se. 7, Se. 24 Q	1.50
Calumet & Hecla	Boston	35	32½	33½	Au. 31, Se. 15 Q	0.50
Cerro de Pasco	New York	104½	94	102½	Jl.12, Au. 1 Q	1.25
Chile Copper	New York	55¼	53	54	Se.15 Se.29 Q	0.62½
Con. Coppermines	N. Y. Curb	12	11¼	12		
Copper Range	Boston	23½	22½	22⅝	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*35	*34	*34		
East Butte	Boston	3¼	2⅞	3	Dec., 1919	0.50
Granby Consol	New York	65	62½	63⅜	Oc.11, No.1 Q	1.00
Greene Cananea	New York	133½	120½	129⅛	Se. 14, Oc.1 Q	1.00
Howe Sound	New York	69	60	67⅛	Se.29, Oc.15, Q	1.00
Inspiration Consol	New York	30½	25	30⅛	Apr. 1927 Q	0.25
Isle Royale	Boston	22⅜	20½	22	Au.31, Se.15 SAX	0.75
Kennecott	New York	101⅞	99½	100⅝	Au.31, Oc 1 Q	1.50
Magma Copper	New York	62½	60½	61½	Oc.1, Oc.15 Q	0.75
Mason Valley	N. Y. Curb	1⅞	1½	1⅞		
Miami Copper	New York	24	21⅞	24	Au.1, Au.15, Q	0.37½
Mohawk	Boston	52½	47½	49½	Jl. 31, Se. 1 Q	1.00
Montana-Idaho	Spokane	*11½	*10	*10		
Mother Lode Coal	New York	3½	2½	3⅜	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	28	26½	27⅜	Se.14, Se.29 Q	0.37½
New Cornelia	Boston	32½	29½	32	Au.3, Au. 20 Q	0.50
Noranda	N. Y. Curb	53¾	50¾	52⅜		
North Butte	Boston	6½	5	5½	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*75	*65	*70	Sept., 1926	0.03
Old Dominion	Boston	16½	15½	15½	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	157	155¼	155½	Se.10, Oc.1 Q	2.00
Quincy	Boston	45	40	41	March, 1920	1.00
St. Mary's Min. Ld	Boston	32⅜	31	31½	Ap.1928 A	2.00
Seneca Copper	New York	4	2⅞	3⅜		
Shattuck-Denn	N. Y. Curb	17⅜	15⅞	17⅛		
Tenn. C. & C	New York	15½	14½	15½	Au., 31 Se.15,Q	0.25
United Verde Ex	N. Y. Curb	16½	15⅜	15⅝	Oc.6, No.1 Q	0.50
Utah Copper	New York	....	....	175½	Se.14, Se.29 Q	2.00
Utah Metal & T	Boston	1½	1½	1½	Dec., 1917	0.30
Walker Mining	Salt Lake	1.87½	1.40	1.85		
NICKEL-COPPER						
Internat. Nickel	New York	130⅛	123½	125⅞	Se.10, Se.29 Q	0.75
Internat. Nickel pfd	New York	115	113½	115	Jl.12, Au.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*4	*3¾	*4	June, 1927	0.005
National Lead	New York	130½	127	128½	Se.14, Se.29 Q	1.25
National Lead, pfd. A	New York	143	142½	143	Au.31, Se.15 Q	1.75
National Lead, pfd. B	New York	120½	120½	120½	Oc. 19, No.1 Q	1.50
St. Joseph Lead	New York	49⅜	44¾	47⅛	Se.8, De.20 QX	0.75
ZINC						
Am. Z. L. & S	New York	49½	32⅜	45⅛	May, 1917	1.00
Am. Z. L. & S. pfd	New York	98	91	96	Nov., 1920	1.50
Butte C. & Z	New York	9⅜	8½	8⅜	De., 1926	0.50
Butte & Superior	New York	12½	10	11⅛	Se.14,Se.29 Q	0.50
Callahan Zn-Ld	New York	4⅜	2⅞	4	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	13	12½	12½	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	18½	18⅛	18½	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	...	...	100	July 15 Q	1.50
Evans-Wallower	N. Y. Curb	7¼	6⅜	6⅞		
New Jersey Zn	N. Y. Curb	243	223	235	Jl. 20, Au. 10 X	2.00
Treadwell-Yukon	Toronto	15	13	15		
United Zinc	N. Y. Curb	...	...	*60		
Yellow Pine	Los Angeles	*25	*25	*25	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	4⅛	3⅞	4		
Ankerite	Toronto	*22	*20	*22		
Barry-Hollinger	Toronto	*57½	*45½	*55		
Central Manitoba	Toronto	1.00	*98	1.00		
Cresson Consol. G	N. Y. Curb	*95	*86	*89	Je.30, Jl.10 Q	0.10
Dome Mines	New York	9⅜	9¼	9⅜	Se.29, Oc.20 Q	0.25
Gold Hill	Toronto	*13	*10½	*12		
Golden Cycle	Colo.Springs	†1.65	†1.64	...	My. 31, Je.10 Q	0.04
Hollinger Consol	Toronto	8.80	8.45	8.75	Se.19, Oc.6 FW	0.05
Homestake Mining	New York	74	73	74	Se.2, Se. 20 M	0.50
Kirkland Lake	Toronto	1.60	1.49	1.49		
Lake Shore	Toronto	22.50	22.00	22.40	Se.1, Se.15, QX	0.20
McIntyre Porcupine	New York	23	22	22	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*19	†*16½	....	Ap., 1927	0.02
Rand Mines	New York	...	...	39½	Au.21-28 Am.Sh	1.52
Sylvanite	Toronto	2.95	2.61	2.85		
Teck-Hughes	Toronto	9.10	8.90	9.05	Jl. 17, Au. 1 SA X	0.15
Tom Reed	Los Angeles	*60	*58	*58	Dec., 1926	0.02
Tough-Oakes	Toronto	*40	*33¼	*33½		
Vipond Cons	Toronto	*61	*55½	*60⅝	April, 1927	0.03
Wright-Hargreaves	Toronto	3.20	3.06	3.06	Jl.16, Au.1 Q	0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	...	...	21		
Con. Cortez	N. Y. Curb	*20	*19	*19		
Dolores Esperanza	N. Y. Curb	1	1	1	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	...	...	15	Jl.18, Oc.28 Q	0.50
Premier Gold	N. Y. Curb	2⅜	2⅛	2⅜	Se.14, Oc.4 Q	0.06
Tonopah Belmont	N. Y. Curb	*70	*70	*70	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*7	*5	*6	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4	3 1/16	4	Se 29,Oc 20 SA	0.07½
West End Consol	N. Y. Curb	...	...	*4	Mar., 1923	0.05
Yukon Gold	Boston Curb	*74	*61	*67	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.00	*93	*99	May, 1920	0.03
Castle-Trethewey	Toronto	*38	*36½	*38		
Coniagas	Toronto	3.90	3.90	3.90	May, 1924	0.12
Keeley	Toronto	*41	*40	*41	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto	...	...	*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.35	3.26	3.31	My.20, Je.13 SA	0.125
Nipissing	N. Y. Curb	3⅜	3⅛	3⅜	Se.29, Oc.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	4½	3	3⅜	Ap., 1927	0.12½
Bingham Mines	Boston	43	42½	42⅝	Se.20, Oc.5 Q	0.50
Bunker Hill & Sullivan	N. Y. Curb	125	125	125	Au.31, Se.4 MX	0.75
Cardiff M. & M	Salt Lake	*50	*50	*50	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	1.72½	1.70	1.72½	Ja.10, Fe.1 K	0.10
Consti'nMng.&Mill'g.	Spokane	*36	*25	*36		
Erupcion	Boston Curb	*20	*18	*18	Ja., 1928 Q	0.07½
Eureka Lily	Salt Lake	...	...	1.70		
Federal M. & S	New York	159½	1.48	159½	Je., 1927	10.00
Federal M. & S. pfd	New York	101	100	100	Au. 24, Se. 15 Q	1.75
Golconda	Spokane	*85	*84½	*85		
Hecla Mining	N. Y. Curb	15	14½	14⅝	Au.15, Se. 1 Q	0.15
Highland-Surprise	Spokane	*9⅜	*8	*9⅜		
Iron King Mining	Salt Lake	*85	*82	*82		
Keystone Mining	Salt Lake	†*34	†*30	...	Fe., 1926	0.07½
Lucky Jim	Spokane	*25	*25	*25		
Lucky Tiger-Com	Kansas City	†6.85	†6.65	...	Se. 6, Se. 20 M	0.05
Mammoth Mining	Salt Lake	†1.80	1.52½	....	De., 1926	0.25
North Lily	Salt Lake	7.95	7.85	7.85		
Park Utah	New York	12	10½	11⅛	Se.,11, Oc.1 Q	0.20
Plutus Mining	Salt Lake	†1.85	†1.50	...	Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*47	*44	*47	June 15 Q	0.03
Sherman Lead	Spokane	*24⅜	*18	*24⅜		
Silver King Coal	Salt Lake	13.37½	13.25	13.37½	Se.20, Oc.1 Q	0.75
Silversmith	Spokane	*12½	*9½	*12½	Oct., 1926 Q	0.02
Strattons Mines	Spokane	1.48	1.38	1.42		
Sunshine M. Co	Spokane	1.40	1.38	1.40	June 20, K	0.02
Tamarack-Custer	Spokane	*36½	*34½	*36½	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.25	14.25	14.25	Se.19, Se.29 QX	0.25
Utah-Apex	Boston	4⅞	4	4⅛	Jl.14, Au.1 K	0.25
IRON						
Bethlehem Steel	New York	67½	64	65½	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	130	125	147½	Jl.14, Jl.25, Q	1.00
Colorado F & I, pfd	New York	74⅜	65	68½	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	23¼	22½	23⅜	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	74	68½	70	Au. 15, Se.1 Q	0.62½
Republic I. & S	New York	89½	84⅛	85⅞	Au. 14, Se. 1 Q	1.00
Republic I. & S. pfd	New York	110	109	110	Se. 15, Oc. 1 Q	1.75
Sloss-Sheffield S. & I	New York	122	120	120	Se.10, Se.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	...	...	111½	Se. 20, Oc. 1 Q	1.75
U. S. Steel	New York	160⅜	157½	157⅞	Au.30, Se.29 Q	1.75
U. S. Steel, pfd	New York	142⅜	141½	141⅞	Au. 6, Au. 30 Q	1.75
Virginia I. C. & C	New York	....	....	27	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	....	....	50	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	24⅞	24⅜	24⅞	Ju.16, Ju.26 K	0.97
So. Am. G. & P	N. Y. Curb	4	3⅜	4		
Alum. Co. of Amer	N. Y. Curb	147	140	140		
Alum. Co. of Amer. pf.	N. Y. Curb	107½	106½	107	Se. 15, Oc. 1 Q	1.75
Vanadium Corp	New York	88½	82½	82⅝	Au. 1, Au. 15 Q	0.75
Patino M. & E	New York	36⅜	33	34⅛	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	29	27⅜	27¾	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	90	89½	90	Jl.30, Jl 16 Q	1.75
SULPHUR						
Freeport Texas	New York	72½	60	62½	Oc.15, No.1 QX	1.25
Texas Gulf	New York	73½	71½	71½	Se. 1½, Se 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	52⅜	49¾	52¼	Au. 21, Se 1 Q	0.75
Amer. Metal, pfd. 6%	New York	113	113	113	Au.15, Se.1 Q	1.50
Amer. Sm. & Ref	New York	256½	250	250	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	137	135	136	Au. 3, Se. 1 Q	1.75
Consol. M. & S	Montreal	270	268	268	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	175½	165½	172	Se.28, Oc.15 Q	1.00
U. S. Sm. R. & M	New York	55	49⅜	53½	Jl. 5, Jl. 14 Q	0.87½
U.S. Sm. R.&M. pfd	New York	54½	54	54	Jl. 5, Jl 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED September 11, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	35/6	35/—	35/—			
Alaska Treadwell ($25)	120/6	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	60/—	55/—	57/6	Aug, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	15/3	14/3	15/—	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	8/4½	7/6	8 3			
Camp Bird (2s)	4/4½	3/1½	4/3	April, 1928	16⅔ p.c.	
El Oro (£1)	4/7½	4/3	4/6	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	11/3	10/—10/—		July 1928	3¾ p.c.	
Mexican Corpn. (£1)	10/—	9/6	9/9			
Mexico Mines of El Oro (£1)	23/9	18/9	20/—	Dec., 1926	3¾ p.c.*	
Mond Nickel	113/9	96/—108/9		Aug., 1928	20 p.c.	
N'Changa Copper Mining	19/9	18/— 19/—				
Oroville Dredging (£1)	4/—	3/4½	3/9	Dec., 1923	3¾ p.c.	
Rhodesian Congo Border (£1)	33/6	30/—	32/6			
St. John del Rey (£1)	12/3	11/7½	11/9	April, 1928	7½ p.c.	
San Francisco Mines (10s)	28/4½	27/6	28/—	July 1928	12½ p.c.	
Santa Gertrudis (£1)	14/7½	14/1½	14/3	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	10/9	9/9	10/6	April, 1917	6¾ p.c.	
S. Amer. Copper (2s.)	2/3	1/10½	2/—	Nov., 1917	75 p.c.	
Tanganyika (£1)	65/6	60/—	62/6	July 1928	5 p.c.	
Union Miniere du Haut-Katanga (Brussels)	11,675	11,400	11,500	July, 1928	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.